# BIBLE NATURE SERIES

NUMBER TWO

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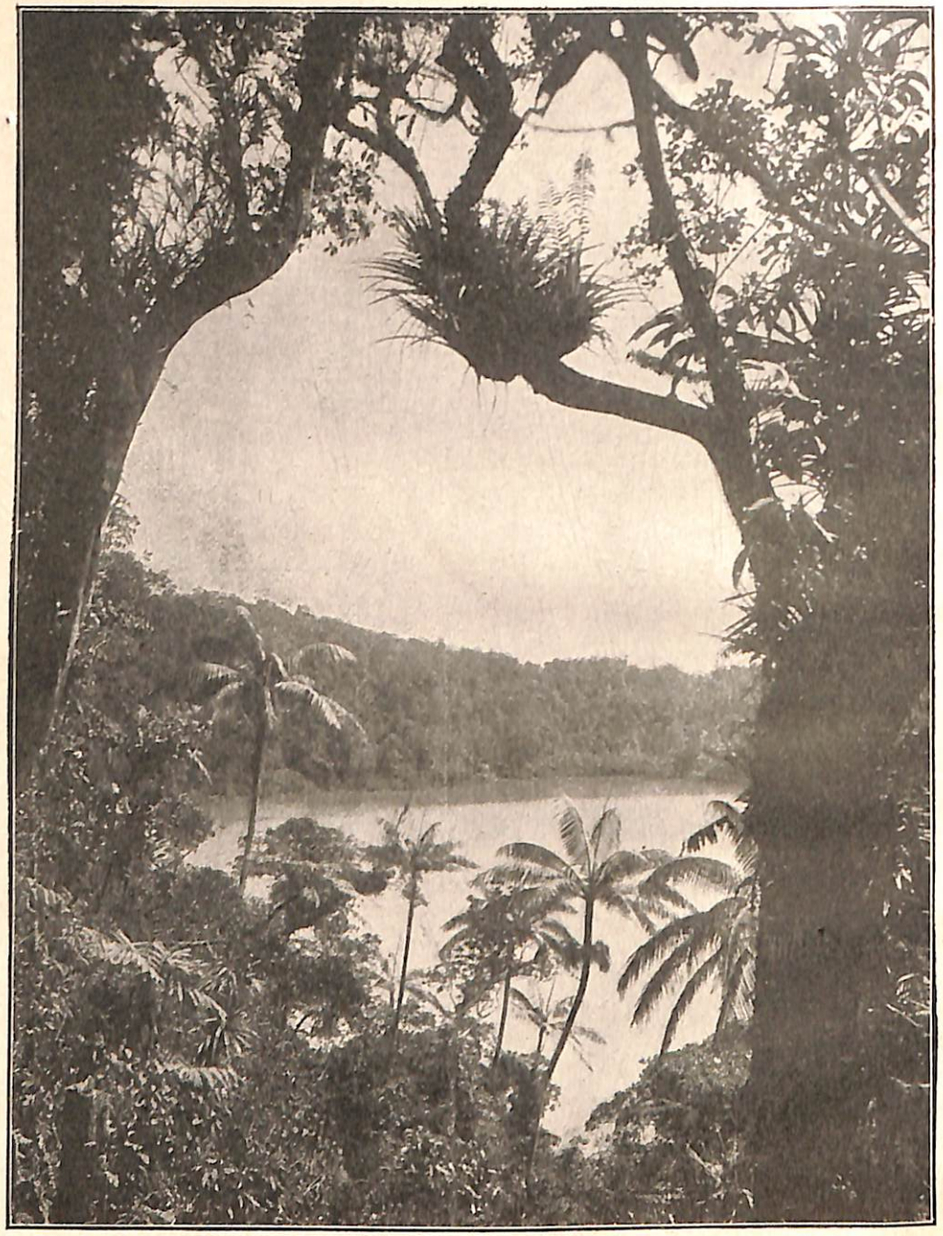

ALL THE YEAR AROUND IN THE TROPICS

A Lake on a Mountain Top, Samoa — 2,500 Feet above the Sea

# Bible Nature Series

## NUMBER TWO

A Natural Development of Geography, Physiology, and the Other Elementary Sciences, with the Bible and Nature as a Basis of Study

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By MARION E. CADY

Author of "Bible Nature Studies," "Nature Study Note Book," "Bible Nature Series No. 1," Etc.

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# THE PREFACE

THE Bible Nature Series consists of three books, and is designed for use in the fourth, fifth, and sixth years of the Primary School. The endeavor has been to present, in three graded texts, elementary studies in Nature, including introductory lessons in Geography, and lessons in elementary Physiology, these lessons being so developed in the light of revelation that all creation may become to the child an expression of divine love, infinite wisdom, and eternal power.

Nature has been marred by sin, but the light shining upon it from the pages of Inspiration makes clear its mysteries. Without this light of God's perfect revelation,—the Bible record,—the facts of creation can not be rightly interpreted, nor their wonderful lessons discerned. Hence, whatever light Inspiration throws upon creation is of infinite value.

Believing that the great Master Builder proceeded to build this world in an orderly and logical manner, each step revealing plan and method in His work, the order of creation has been adopted as the order of progression in the development of the lessons in each of the three books of the Bible Nature Series. The work of creation was followed by the disobedience of our first parents, which resulted in bringing death and destruction into the fair creation. But God has provided a plan to redeem man,—the plan of redemption. So, following the lessons on creation, briefly and simply are developed lessons giving the story of redemption from Adam's fall until he shall take his place again in Eden—the Eden restored.

It is upon this plan that this book has been constructed, and it is upon this plan that each of the succeeding books of the Series is to be constructed. It is not designed that there shall be a jumping from topic to topic, but that, in the logical order of the creation sequence, such a natural advance shall be maintained as shall tend to develop in the pupil's mind a need for the next topic to



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be presented. Thus it is believed that a unity and a mutual dependence of the several years of study in all elementary science work may be laid in the Primary School upon the completion of the sixth year.

Following the lessons in nature work, the student is prepared for an introduction to the elementary sciences as separate studies. Having been introduced in the Bible Nature Series to the subject of Geography, and having mastered all of that subject that is usually included in a primary Geography, he should now be able to complete an advanced Geography in the seventh year. Likewise a text in Physiology is now needed, and may be completed in the eighth year.

It is confidently believed that the work in Bible Nature Study, Geography, and Physiology provided for the Primary Schools will lay an excellent foundation for all further study of the sciences in both Intermediate and Training Schools.

But best of all will be the ability gained by the pupil to discriminate between truth and error. He will have learned how to use the unerring standard—the Bible—in the study of creation, and to reject all that is "science falsely so called," whose fruit is infidelity and skepticism.

*Special Features.*—To accompany the text, Note Books have been prepared for the pupil's use. These are profusely illustrated with appropriate and beautiful pen drawings. These Note Books, in the hands of the pupils, will greatly aid the teacher in carrying on the Nature Study work. Nature Study Drawing and Note Book No. 2 is designed to accompany No. 2 of the Bible Nature Series, and the Note Book Requirements suggested in connection with the lessons in the text may be executed in this book. Thus is the pupil encouraged to give back to the teacher in drawings and compositions what he has received in study and in recitation. In this way, work is provided for the hand as well as for the head, and facts are more deeply impressed upon the memory by means of reproduction.

Especially are the Skeleton Outline Maps accompanying the Note Books valuable as a means of making graphic the facts of the text, and impressing not only physical and political outlines, but especially the principles of Physical Geography, which are largely responsible for the industrial and political conditions of



to-day. The repeated lettering of names upon these skeleton maps is an effective device for teaching Spelling, as, upon correct outline maps, the pupil is requested to show the physical and political features of the hemispheres and continents studied.

The Note Book Requirements are by no means intended to be arbitrary, but only suggestive. Many teachers may wish to make their own requirements. Others will be able to supplement those given, and adapt them to the needs of their particular classes.

A general treatment of certain subjects has been necessary in order to make such study possible for all children in all localities. By suggestive questions, however, an effort has been made to localize such topics for the individual pupil. The child should be encouraged to study his own environment, and to explain its life and conditions by the universal facts presented in the text.

*Illustrations.*—The illustrations have been chosen, not for their value as mere pictures, but for their teaching and illustrative value. These have been largely selected from private collections, although many drawings have been made especially for the text.

The lessons in the Bible Nature Series are the result of simplifying and properly grading the subject-matter contained in "Bible Nature Studies." These lessons have been adapted for use by being worked out in the schoolroom, with children in the grades for which the books are designed. This work has been done by Miss Katharine B. Hale, director of the Walla Walla College Normal Department, a teacher eminently fitted and qualified both by education and experience to successfully accomplish this task.

Helpful suggestions and criticisms will be welcomed by the author.

M. E. CADY.

*College Place, Wash., Jan. 1, 1910.*

## Suggestions to Teachers

The following are a few points that the teachers should constantly emphasize in teaching the Bible Nature lessons:—

1. The Bible is the only unquestionable source of authority in the study of God's created works. Develop in your pupils an intelligent, living faith in the word of God.

2. From the known to the unknown, from the earthly to the heavenly, from the natural to the spiritual, is the divine method in teaching, as illustrated by the Great Teacher in the parables He uttered. If you stop short of the spiritual, your pupils will suffer an irreparable loss. You have fed them husks and shucks, but no kernel, no meat.

3. As far as possible, teach directly from nature. If you can not go out to it with your pupils, then if possible bring it to them. Put yourself out to provide the materials necessary for illustrating the lessons. "Nature is a living, healthful teacher."

4. Have your pupils give back to you what you have given to them. This they can do orally, by drawings, and by compositions. What the pupils give back to the teacher they know, but what you give to them they may not comprehend. Test their knowledge frequently. Insist on definiteness and accuracy of expression, whether oral or written. Clear statements, correct spelling, legible writing, good drawing, are important elements in an education, and can be wonderfully developed in the Bible Nature classes.

5. Do not allow your pupils to use words or scientific terms which they can not correctly spell and define. Have frequent spelling and definition tests, and take these into account in giving credits of standing.

6. The knowledge of creation is the knowledge of the Creator. His knowledge and wisdom are expressed in the things of nature. Impress upon the pupils that they are thinking the thoughts of God as they study and contemplate His works. Creation and redemption will be the ever-delighting and never-ending themes of study throughout the years of eternity. Impress upon the pupils that in the Bible Nature lessons they begin a study which, if rightly carried forward, will never end, and that a righteous character is the only passport that will insure admission to the heavenly school.

M. E. C.

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## CHAPTER I

# IN THE BEGINNING

*(Scripture Basis, Gen. 1:1, 2)*

*"Darkness was upon the face of the deep."*

## Lesson I

### *God's Plan in the Beginning*

**For thus saith the Lord that created the heavens; God Himself that formed the earth and made it; He hath established it, He created it not in vain, He formed it to be inhabited: I am the Lord; and there is none else. Isa. 45:18.**

Our God is a God of love. He is the Creator of the heaven and the earth, and His plan in creating this world was the plan of a wise and loving Father.

Had the Creator done nothing more than is mentioned in the first two verses of Genesis, still His great power

would have been shown. It takes infinite power to make one world, even though it be void, and covered with darkness.

But if God had stopped at this point, His work would have been in vain. Isaiah tells us why God created the earth. "He formed it to be inhabited." It was His desire to make it a home for His children. Before God began the work of creating this world, He had planned to people it with a race of holy, happy, sinless beings.

We can better understand the heavenly Father's love when we think of an earthly father, and that which causes him to provide a pleasant and beautiful home for his children. But before he begins to build,— before the frame is erected, before the foundation is laid, before a stroke of work is done, in fact, before the materials for building are brought together, the father carefully plans the home he is about to make. He thinks it all over beforehand. He thinks about the rooms — how many there shall be, and the size of each. He plans how each room shall be used. He imagines he is seated with his family around the table in the cheerful dining room. In imagination he spends many pleasant evenings chatting with his family before the large, comfortable fireplace in the sitting room. All these thoughts have prompted the father to build an inviting home. The love of the father for his children is proclaimed by the sound of the plane, saw, and hammer, as they shape the raw materials into a building.

So must our heavenly Father have thought, felt, and planned, when He built this earth to be our home. Before He began the work, He thought of us, His children, who were as yet unborn. At every step of the work, the great heart of God was moved by love. While yet the earth was without form, and void, and covered with darkness, our heavenly Father saw His children in their Eden home. He saw them listening to the songs of the birds. He saw them examining the beautiful flowers. He heard them praising their Creator for the wonderful gifts of His love. The earthly father delights in seeing his children enjoy and appreciate the comforts and pleasures provided for them. How much more does our heavenly Father enjoy bringing comfort and blessing to His children!



I believe that you will be able to see that God's creation reveals not only His love, but also His power and wisdom. Still, it was love that caused God to exercise His great power, and it was love that caused Him to manifest His wonderful wisdom in creating this earth. We shall see this more and more clearly as we study the things He has made.

### Questions

1. Why did God form the earth?
2. What helps us to understand the heavenly Father's love?
3. What does God expect from His children in return for His great love bestowed upon them? 1 John 4:19.
4. What did the beloved disciple exclaim when he thought upon God's great love to us? 1 John 3:1.
5. What besides love did our heavenly Father show in His work of creation?

**Note Book Requirement**

On page 5 of "Nature Study Drawing and Note Book No. 2" copy from the Bible the following texts: Ps. 40:5; Ps. 92:4, 5.

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## Lesson II

### *Creation and Formation of the Earth*

**In six days the Lord made heaven and earth, the sea, and all that in them is, and rested the seventh day. Ex. 20:11.**

We have learned that in the beginning the earth was without form, and void. When first created, it was an unshaped, empty land mass, over the surface of which rolled the great deep. Dense darkness covered the face of the waters. But the Spirit of God was present to bring beauty out of *chaos*.

The work of God in preparing this earth for man to inhabit may be divided into two steps, creation and formation. In the first place God created matter. A person, before he can make anything, must have material to make it from. But God made the world from nothing. He "calleth those things which be not as though they were."

The second step in the work was the shaping of the earth, and the forming of the beautiful and useful things about us. The soil, at the command of God, brought forth grass, and herbs, and trees. From the soil there were also created cattle, and beasts, and creeping things. The water brought forth fishes, and all other creatures which live in the sea. The Creator spent six days in this work of making the earth a beautiful dwelling place for man.



"And God saw everything that He had made, and, behold, it was very good." The earth was exceedingly beautiful. Among the plants there grew no briers nor weeds; and none of the animals were fierce or offensive, as many now are.

Upon the first two days of the creation week, light, heat, and air were created. Why was this? There were as yet no creatures to use the light, to feel the heat, or to breathe the air. No; but God was making preparation, during the first two days, and during a part of the third, for the planting of a garden. Light, heat, and air are agents which God intended to use in carrying out His great plan. The dry land, made green with vegetation, must be watered. Later we will learn more of the way in which this was done. Permanent light and heat givers also must be provided. Then, from the formless, void land and water, the Spirit of God fashioned the creatures of earth, and gave to each the breath of life.

**Spell and define**

cha′ os  a′ gent  cre ate′  per′ ma nent

**Questions**

1. Name the two steps in God's work during creation week.
2. Name in order the special acts which made this earth a beautiful habitation.
3. Out of what were the plants formed?
4. Out of what were earth's creatures formed?
5. Out of what was man formed? Gen. 2:7.
6. What were used as agents in shaping the earth?
7. Who acted for God in the work of creation?

# Lesson III

## *Form and Size of Our Earth*

It is He [the Creator] that sitteth upon the circle of the earth, and the inhabitants thereof are as grasshoppers; that stretcheth out the heavens as a curtain, and spreadeth them out as a tent to dwell in. Isa. 40: 22.

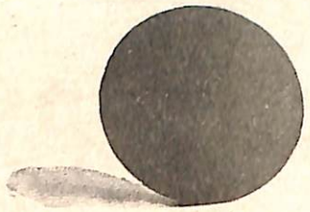
The true form of the earth has not always been understood. For many years it was believed that the earth was a flat surface surrounded by water.

In later years, those who studied the sky observed that the shadow of the earth upon the moon, during an

WHEN APPROACHING LAND THE SUMMITS OF THE MOUNTAINS APPEAR FIRST

eclipse, was always circular. Now, only spherical objects *always* throw a circular shadow, and this fact led some to believe that the earth is round. Then, too, as all the other heavenly bodies are spherical, people concluded that the earth must be similar in shape.

Soon men began to take longer voyages. They ventured farther away from the land. They observed that when approaching the land from any direction, they could always see the summits of the mountains long before the larger base below came into view. Not only in crossing the water, but also

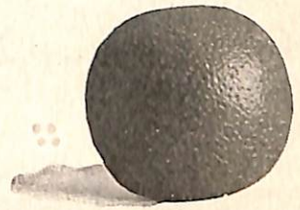


THE EARTH IS ROUND LIKE A BALL



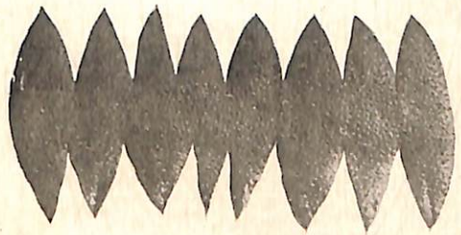
upon crossing the plains, one can see first only the summits of the distant mountain peaks. Finally men sailed around the earth, and thus it was proved that without doubt our earth is a great *sphere*.

If we hold up a large orange, we may think of it as a small *globe* that will tell us something about the much larger globe on which we live. Let us take some spot on the orange to represent our home on the earth. We can move our finger around the orange in any direction, and come back to our starting place.



AN ORANGE IS SPHERICAL IN SHAPE

It is difficult to think of the earth as a sphere, because the surface, as far as we can see, appears to be flat, or broken only by hills and mountains. The surface of an orange, no doubt, seems flat to the tiny creeping insect; but our earth is so large *we* can not see as great a share of *its* surface from our home, as the tiny insect can see of the curved surface of the orange.



AS AN ORANGE WOULD LOOK OPENED OUT FLAT

Indeed, the earth is so very large that we can form no clear idea of its size. It is more than 25,000 miles around. If there were no land to hinder, a steamship, sailing steadily at the rate of 500 miles a day, would take about fifty days to sail around the earth. Were there no large bodies of water, and could a railroad be built

around the earth at the Equator, it would take a fast train, traveling day and night, nearly a month to carry one this distance.

The Bible says, "He hath set a compass [circle] upon the face of the depth;" and it is the circle, or curve, which God placed upon the earth at creation, that makes it spherical in form. We also read that the Creator "walketh in the circuit of heaven;" so we see that there is no mistake about our conclusion that the earth is a sphere.

**Spell and define**

| | | | |
|---|---|---|---|
| sur′ face | spher′ ic al | base | E qua′ tor |
| e clipse′ | sum′ mit | globe | com′ pass |

**Note Book Requirement**

On page 6 write a story about the form and size of our earth.

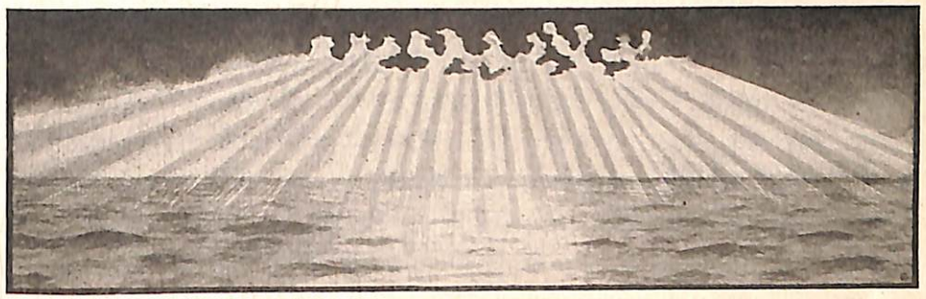
**Outline for Story**

1. What was formerly believed concerning the form and size of the earth.
2. Proofs of its true form.
3. Facts concerning its size.

## CHAPTER II

# LIGHT AND HEAT

*(Scripture Basis, Gen. 1:3-5)*



*"And God said, Let there be light: and there was light."*

## Lesson IV

### *The Entrance of Light*

**God, who commanded the light to shine out of darkness, hath shined in our hearts. 2 Cor. 4:6.**

We have already learned that the Creator spent six days in creating the earth and the things which it contains. Now it is our plan to study each of the wonderful acts of creation, so that we may better appreciate them, and see in each one a revelation of the power, wisdom, and love of God toward us, His children.

I am sure that a right study of these things will increase our love and reverence for the God of nature. On

one occasion when David was studying the wonderful works of God, he was so impressed with their greatness, and the wisdom of the Author, that he exclaimed from the fulness of his soul, "O Lord, how manifold are Thy works! in wisdom Thou hast made them all: the earth is full of Thy riches."

Do we have feelings like David's when we behold the objects of nature about us? We should follow his example. He tells us just how he did. "I *meditate* on *all* Thy works; I *muse* on the work of Thy hands." He did not look upon God's handiwork in a careless, indifferent way, but he *meditated* upon it. He did even more; he *mused* on God's works, which means he thought very deeply about them. And David tells us how this close study of nature made him feel toward his Creator: "I stretch forth my hands unto Thee: my soul thirsteth after Thee, as a thirsty land."

After creating the world, God's next work was the creating of light. The earth had just been born, and it was still wrapped in the swaddling bands of darkness; when, lo, the voice that had spoken the world into existence, spoke again, saying, "Let there be light." We are not told how the light was caused to shine upon the earth, or whence it came; in obedience to the heavenly command, light shone out of darkness. The earth was thus lighted until it had turned three times upon its axis and the fourth day had dawned. On this day, God ordained the sun to give light by day, and the moon and stars by night.

But the light from the sun is God's light, just as truly



as was the light which shone upon the earth during the first three days of the creation week. God has placed a portion of His light and glory in the sun, in the moon, and in the stars, that we may behold and enjoy the blessings which they bestow. "Truly the light is sweet, and a pleasant thing it is for the eyes to behold the sun." We can appreciate this saying after we have been denied the privilege of seeing the sun's smiling face for several days.

God wishes the beautiful light, with all its blessings, constantly to remind us of "the true Light, which lighteth every man that cometh into the world." He is the Light of the world, and His beams can drive from our hearts all that is dark and evil. Satan is the prince of darkness, but Jesus is the Prince of Light.

**Questions**

1. What did the study of God's works cause David to exclaim? Ps. 104: 24.
2. How did David regard the works of God's hand? Ps. 143: 5.
3. How did this close study of nature make David feel? Verse 6.
4. How was light brought into existence? Gen. 1: 3.
5. What part have the sun, moon, and stars in the giving of light? Ps. 136: 7-9.
6. What did Solomon say of the light? Eccl. 11: 7.
7. Of what is darkness a sign, or symbol?
8. Who is the true Light? John 1: 9, 10.
9. For how many people did God create the blessing of physical light?
10. For how many did He create the blessing of spiritual light -- light that will chase away the darkness of sin?

**Note Book Requirements**

1. On page 7 make a drawing of the earth, showing the line known as the earth's *axis*, the circle known as the *Equator*, and the *North and the South Pole* of the sphere.
2. Explain in your own words the cause of day and night upon our earth, and God's wisdom in this arrangement.

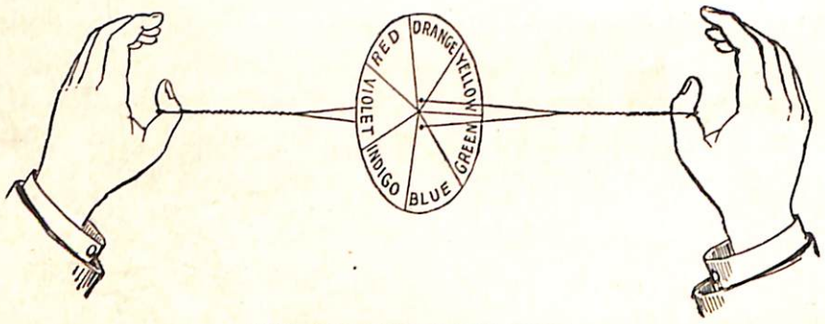
---

## Lesson V

### *How Different Colors Are Made*

As the appearance of the bow that is in the cloud in the day of rain, so was the appearance of the brightness round about [God's throne]. Eze. 1:27.

You have already learned that color depends upon light, and that, in every tiny sunbeam, there are seven bright rays of color. Do you remember how we discovered this



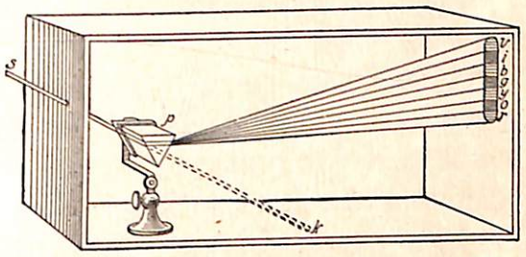

THE COLORED DISC BUZZ

fact by means of the prism? Do you remember how we learned, too, that these rays of color may be separated from each other not only by the glass prism which you held in your hand, but also by means of the countless tiny,



falling spheres of water when they are seen in the path of the sunbeams? Thus in one slender beam of sunlight are given all the beautiful colors of the *spectrum*, or the rainbow.

These colors of light, falling upon the objects about us, are treated by these different objects in the greatest possible variety of ways. Sometimes all the color rays are greedily caught and held by an object; at other times not every color is held fast. In this way the different objects throw back to our eyes different colors, sometimes one color, and sometimes another, delighting us with a variety of gay beauty. In the plumage of birds, in the covering of insects, in the foliage of plants, in the stones at our feet, and in the sky overhead, we see the gorgeous and delicate coloring of the wonderful light. "In earth and air and sky, with their marvelous tints and colors varying in gorgeous contrast or softly blended in harmony, we behold His [God's] glory."



RAY OF LIGHT SEPARATED BY A PRISM

All this reveals our Father's love and wisdom, too; for how does He so construct the petals of a certain flower that it shall throw back to our eye only the red rays, holding fast all the other rays of light? and how does He so construct another flower that it retains all the color rays save yellow, or orange, or blue, or violet? Is this not wonderful?

You see that the color of an object is not a part of the object itself, but depends altogether upon how that object treats the light when the light comes to it. Colors change with different kinds of light. The light of a lamp may not give to an object exactly the same color that the sunlight would give it. A garment that looks white by candle light may look quite yellow by the light of day.

Color, then, is something that must be made every moment. The light is God's agent for making color. If an object looks green to you, it is because the green color is made out of the light which falls upon the object while you are looking at it. The tiny blade of grass throws back to your eye the green rays of light, and the green rays only, absorbing, or holding fast all the other color rays. A green pane of glass allows only the green rays to pass through its substance, absorbing from the passing sunbeams all the other rays of color. When an object throws back, or passes on, *all* the colors of the spectrum, it is white. When an object passes on *none* of the color rays, but *absorbs them all*, it is black, or without color.

SIR ISAAC NEWTON

It was Sir Isaac Newton who first discovered that white contains all other colors. This interesting man lived about two hundred years ago. He made a wheel on the side of which he painted all the seven colors. When he whirled the wheel very fast, the colors all went to his eye mixed together; and being



mixed, they made white, just as they do in a beam of light. The rim of the wheel, when whirling rapidly, looked to him as if it were white. He also proved the same with powders, for he found that powders of different colors, when mixed in the right proportion, produced a substance nearly white in appearance.

The ability to distinguish color, is a great blessing. Four or five out of every hundred persons, it is said, are color-blind; that is, they are unable to see certain colors. One may be color-blind and not know it till the defect is exposed by some accident. The most common form of this defect is the inability to tell red from green. It is of great importance to detect color-blindness in those employed on steam and electric railways, on shipboard, on automobiles, and in all other places where red and green signals are used.

There is another kind of color-blindness that is more serious than the inability to tell red from green, or blue from purple. There are people who can not tell right from wrong. The law of God is the standard by which every action must be judged in order that we may see it in its true color. All who are not acquainted with this standard, are in grave danger. They are blind, as it were, not knowing good from evil. Jesus came to open the eyes of the blind. He came to teach us how to detect evil, that we may shun it; and how to know good, that we may choose it.

**Spell and define**

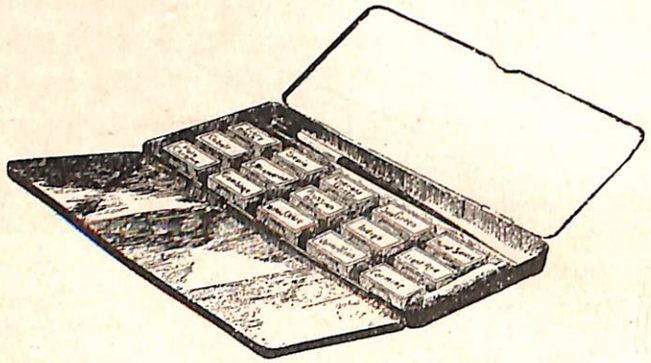
spec′ trum prism ab sorb′

### Questions

1. From what three colors are all other colors made?
2. What two colors, when mixed, produce green?
3. How can purple be obtained by mixing two other colors?
4. What two colors produce orange?
5. Of what does darkness remind you? Of what does light remind you?
6. Which reveals more loveliness, the darkness, or the light?
7. Which is the more beautiful, right doing, or evil doing?
8. By which standard can we better judge color, the daylight, or artificial light?
9. By what standard should we judge duty? Ps. 119:105; John 8:12.
10. Where did the prophet Ezekiel see the appearance of the bow? Eze. 1:28.

### Note Book Requirements

1. Color the discs and disc buzz pictured on pages 8 and 9, as suggested by the drawings; and after placing these colors upon discs of stiff cardboard, record upon these pages what you observe while whirling the cardboard discs.
2. From your box of water colors, paint across page 9 a large picture of the bow of God's covenant, being careful to get the colors in the right arrangement. Copy under this drawing the words of the covenant of which the bow is a reminder. Gen. 9:13-16.



A BOX OF WATER COLORS



# Lesson VI

## *Reflection of Light*

As in water face answereth to face, so the heart of man to man. Prov. 27:19.

We see the sun, the flame of a candle, or a flash of lightning, by the light which is made by these different objects. Some of the light made by these objects comes directly to our eyes, and thus we see them.

REFLECTION OF FACES IN WATER

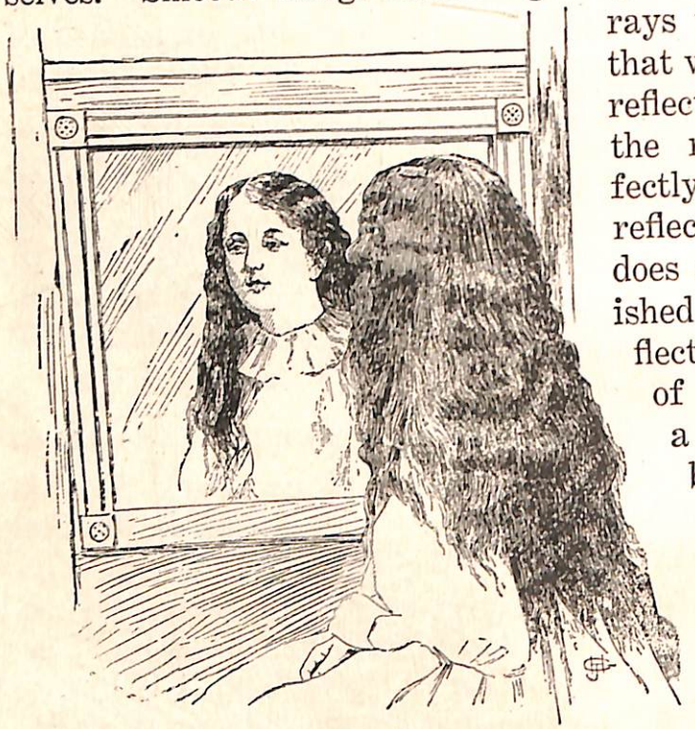
But no light is made by houses, and trees, and persons, and many other things that we see about us. How then is it that we see these objects which give no light? You have often thrown a rubber ball against the walk or the side of the house. The ball returns with a bounce. In like manner, when the light from the sun falls upon the different objects around us, it bounds from them. When light bounds off in this way, it is said to be *reflected;* and it is by reflection that we see the objects which give no light of themselves. The light that is reflected from the surface of the object, comes in a straight line to the eye, and makes a picture, or image, there, of the object we see.

REFLECTION OF FOLIAGE IN WATER

Light is often reflected more than once. When one looks into a mirror, the light is reflected from the person

to the glass, then it is reflected from the glass to the eye, and thus the image of his face is seen.

Everything reflects light. Rough objects reflect light by scattering the rays, and then we see the objects themselves. Smooth things reflect light by sending back the rays to our eyes, so that we see the thing reflected instead of the reflector. Perfectly smooth water reflects the light as does a mirror. Polished surfaces reflect a great deal of light. When a person stands before a mirror, the image seems to be placed just as far behind the mirror as the person is distant in front of it. This is why a little child will sometimes look behind the mirror for the image which he sees reflected to him.

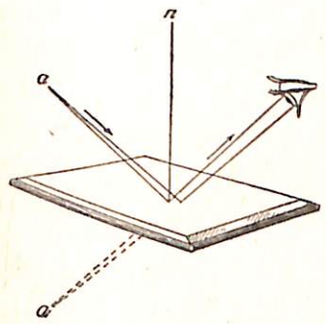


AN IMAGE

You will notice that in the mirror the image is turned so that the right hand seems to be the left, and the left hand seems to be the right. If you step to the left, you



will see in the mirror the objects at the right of the room. If you step to the right, the light from the objects on the left will be reflected to your eye. To explain why this is so, study carefully the drawing of a mirror and a reflected sunbeam. The mirror is placed horizontally before your eye. The sunbeam, traveling in the direction of the arrow from the point *a*, falls slantingly upon the mirror, and is reflected in the direction of the second arrow to the eye. A perpendicular line dropped to the surface of the mirror at the point where the sun ray falls upon it, shows that the angle which the reflected ray and the perpendicular line make, is exactly equal to the angle between the perpendicular line and the path of the falling sunbeam. This is always found to be true, and is called *the law of reflection.* If the path of the light is nearly perpendicular, the path of the reflected ray will be nearly perpendicular. If the sunbeam falls more slantingly than this upon the surface of the mirror, the reflected ray will travel in a more slanting direction. If the falling sunbeam is directly perpendicular to the surface of the mirror, the path of the reflected beam will travel back over the same perpendicular line.




REFLECTION OF LIGHT

Light is sometimes reflected more than twice. It is reflected back and forth from one object to another, and in all directions, from every point on those objects. This is why, to a thousand eyes at once, light can carry the

same picture. What a wonderful thing light is! How many pictures it is carrying all the time to the eyes of men and animals!

We are told in the Bible that God's word is a light. It will make a plain pathway. It is like a mirror, reflecting to us a picture of the beautiful life of Jesus. Jesus says, "I am the light of the world." He reflects to us the glorious light of the Father's will. Jesus came to our world to manifest His Father. "Whatsoever doth make manifest is light." All who are Christlike will be lights, too. They will shine by reflected light, and manifest God to the world.

**Spell and define**

| | | |
|---|---|---|
| re flect′ ed | man′ i fest | im′ age |
| re flect′ or | per pen dic′ u lar | an′ gle |
| re flec′ tion | hor i zon′ tal ly | sur′ face |

**Questions**

1. As you bounce a ball, what direction does it take when thrown perpendicularly against a surface?
2. What direction will it take when thrown slantingly?
3. Can you explain, then, the direction taken by a ray of reflected light?
4. What distance behind the surface of the mirror does the object reflected always appear to be?
5. When can the image be most clearly seen,—when near the mirror, or when far away?
6. Can we expect, then, to see clearly God's will, if we stand far away from His reflectors?
7. Name all the natural reflectors you can think of. Name some spiritual reflectors.
8. Why is a polished reflector of especial value?



Note Book Requirement

On page 10 there are drawings of two mirrors. Explain these drawings, and tell how the girl in the picture sees her image as she looks at the surface of the mirror.

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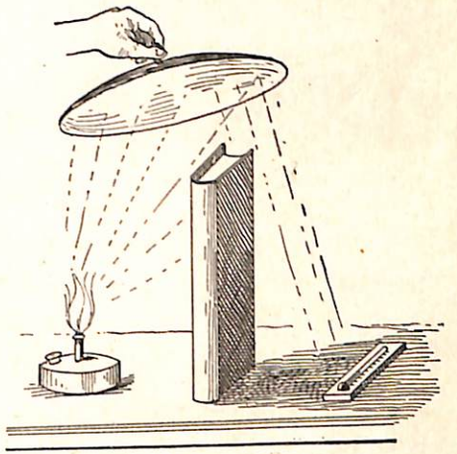
# Lesson VII

## *How Heat Is Produced*

**His [the sun's] going forth is from the end of the heaven, and his circuit unto the ends of it: and there is nothing hid from the HEAT thereof. Ps. 19: 6.**

We have already learned that *heat* is the companion of light, and that when the heat of the sun's rays is thrown by a lamp reflector upon cloth or paper, fire is produced. This is because the curved surface of the reflector collects the heat rays and throws them back upon one spot. We find in the study of heat, that it is reflected the same as light. You have doubtless noticed that highly polished metals reflect more heat than do other objects.



REFLECTION OF HEAT

A lamp, a candle, a stove, all send out heat rays in every direction. These rays of heat pass out in straight lines through the air to the objects about them, and are reflected from the walls of the room, and from the articles of furniture upon which they fall.

If the heat rays fall perpendicularly upon a surface, they rebound perpendicularly. If they fall slantingly, they are reflected in a slanting direction. Did you ever notice that on a warm, cloudy day, it is much more sultry than on a warm but clear day? Low clouds do not prevent the heat rays from passing to the earth; but when the rays are reflected from the earth into the atmosphere, the clouds act as reflectors, throwing them back again.

CLOUDS AS REFLECTORS

Heat is often made without apparent light. This is the case with the heat of our bodies. We wear clothing to keep the heat which is made in our bodies from passing off too fast. A great deal of heat is produced in the bodies of animals; and the more active they are, the greater the amount of heat. This is because when one is exercising, blood is sent more rapidly all over the body, and there is consequently a greater manufacture of heat.

Heat is also produced by friction. Savages kindle fire by rubbing two sticks together. Saws become heated in sawing timber; and the hands may be burned by slipping down a rope very rapidly. The woodwork of machinery has been known to take fire from the heat caused by friction. At night a spark may be seen when a horse's shoe strikes a stone.

You know how easily a match is lighted by rubbing it. This is because there is on the end of the match a



substance that burns with very little heat, and so needs but little friction to set it on fire. This curious substance is a mixture of phosphorus and sulphur. Phosphorus *ignites* without friction, and must be kept under water to prevent burning. It sets the sulphur on fire; and the sulphur, in turn, sets the wood on fire.

HEAT PRODUCED BY FRICTION

Before matches were invented, a very common way of starting a fire was by striking a piece of flint with a piece of steel over some tinder. A good deal of patience was needed in starting a fire with a tinder box, because a spark was not always easily caught.

**Spell and define**

| | | | |
|---|---|---|---|
| per pen dic′ u lar | fric′ tion | sul′ phur | flint |
| phos phor′ us | ig nite′ | tin′ der | steel |

**Note Book Requirements**

1. On page 11 explain what happens to the mercury in the thermometer when the lamp reflector is held over the candle flame, even though a thick book separates the candle and the thermometer; and tell why this is so.
2. Explain why heat is called the companion of light.

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## Lesson VIII

### *The World's Great Climate Belts*

**And when ye see the south wind blow, ye say, There will be heat; and it cometh to pass. Luke 12: 55.**

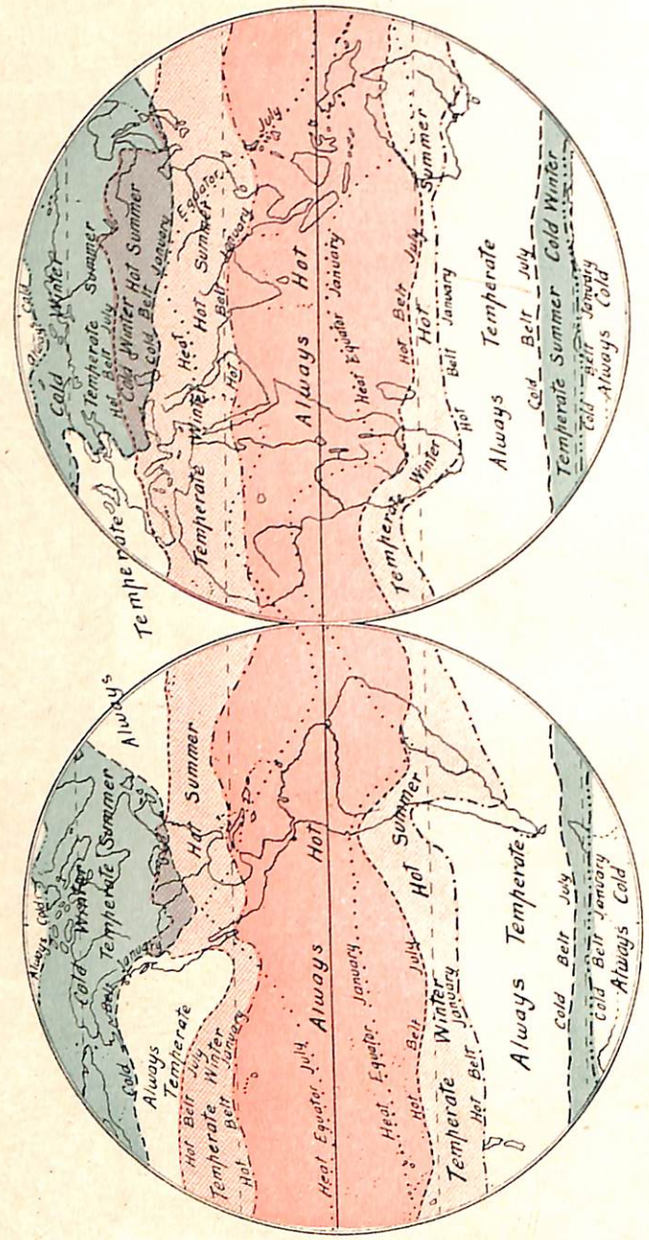
When we wish to refer to the kind of weather a region usually has, we speak of the *climate* of that region.

The most important feature of the climate, and of the weather, and the one we talk most about, is the *temperature;* that is, the heat or cold of a region. If it is too cold for comfort, we try to warm our houses; and if it is too hot, we shut out the sun's heat as much as practical, and do everything we well can to keep cool.

We have already learned that the world is divided, according to the temperature, into five great belts, or regions, known as heat belts, or *zones.*

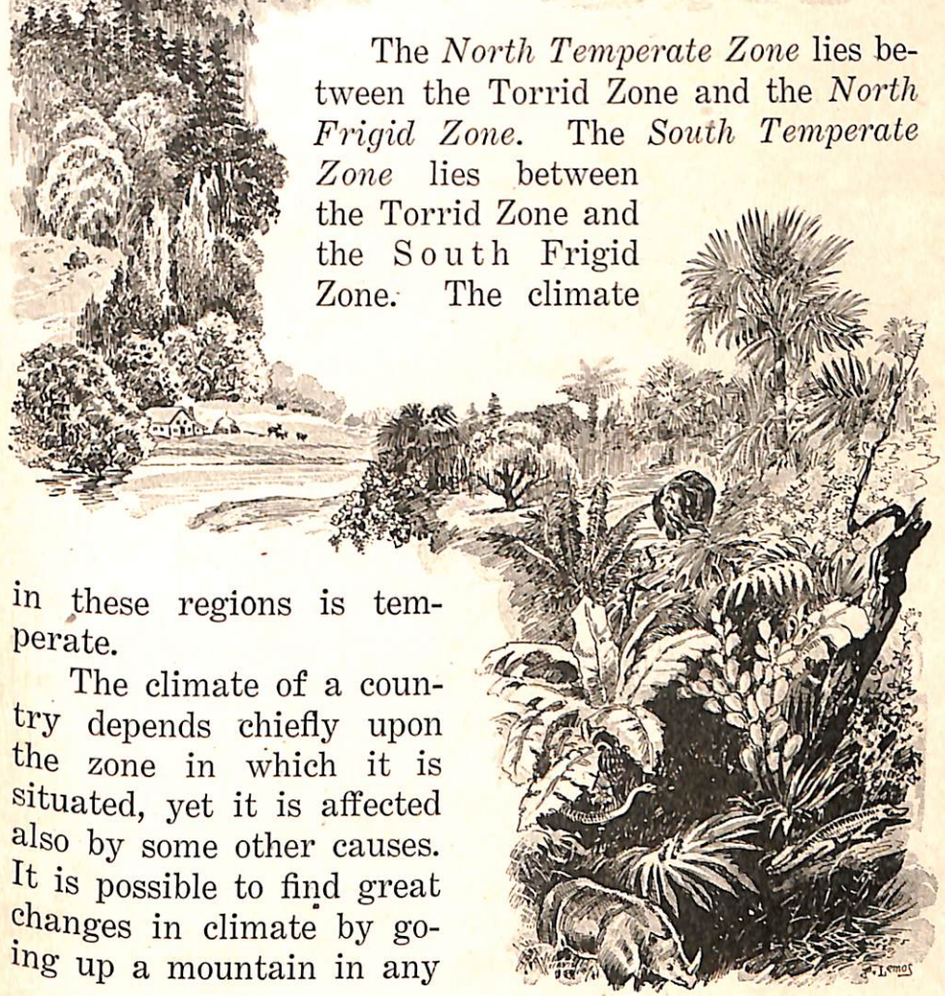
You have learned that the climate of the earth is not uniform, but that it is very hot at the Equator, and grows colder as we approach either of the poles. On each side of the Equator, for more than fifteen hundred miles, it is very warm; and this portion of the earth is called the *Torrid Zone.* All countries lying within the limits of this zone receive, for the greater part of the year, the direct rays of the sun; and over this vast belt the heat is intense.

For a distance of more than fifteen hundred miles from each pole, it is very cold; and these polar regions are called the *Frigid Zones.* The region around the North Pole is called the *North Frigid Zone;* and the region around the South Pole is called the *South Frigid Zone.* Here the slanting rays of the summer sun are not sufficient to melt the ice and snow; and in these frigid regions nothing but moss and small plants are found growing. The sun is never directly overhead, but circles around the horizon. The Frigid Zones are also known as the *Polar Zones,* since they surround the poles.




HEAT BELTS OF THE EARTH

The *North Temperate Zone* lies between the Torrid Zone and the *North Frigid Zone.* The *South Temperate Zone* lies between the Torrid Zone and the South Frigid Zone. The climate in these regions is temperate.



The climate of a country depends chiefly upon the zone in which it is situated, yet it is affected also by some other causes. It is possible to find great changes in climate by going up a mountain in any

part of the world. The upper air is always colder than the lower air; and the greatest highlands, even in the Hot Belt, reach into the region of perpetual snow. The line of perpetual snow is higher up the mountains in the Hot Belt than in the Temperate Belts, because the lowlands are warmer, and one has to rise higher to reach air that is freezing cold. The climate of a region is greatly affected, also, by its distance from the ocean or from any large body of water. This is because water is not so easily heated as soil, and because it loses its heat more slowly than does the soil. Hence regions near the seacoast have usually a more even climate than do regions remote from any large body of water.

**Spell and define**

| | | |
|---|---|---|
| cli′ mate | tem′ per a ture | Frig′ id Zone |
| tem′ per ate | per pet′ u al | Tor′ rid Zone |

**Questions**

1. In what country did Jesus live?
2. In what climate belt does that country lie?
3. Why would the south wind be warm?
4. On which continent is the south wind coldest?
5. Mountains are nearer the sun than the lowlands. Why, then, is there more heat in the lowlands than on the high mountains?

**Note Book Requirement**

On page 11 draw a diagram of the earth, showing the heat zones, coloring the Torrid Zone with red crayon, the Temperate Zones with yellow, and the Frigid Zones with blue.



# Lesson IX

## *Effect of Climate upon Bodily Heat*

They shall not hunger nor thirst; neither shall the heat nor sun smite them: for He that hath mercy on them shall lead them, even by the springs of water shall He guide them. Isa. 49:10.

The temperature, or inside warmth, of the body, is the same at every season of the year. Unless one is ill it is the same in every climate. Fevers may cause the temperature of the body to rise, and sometimes in ill health the temperature falls below normal; but when we are well, the body has the wonderful power of resisting both the heat and the cold.

IN POLAR REGIONS

For this reason people are able to live in all climates. The Eskimo who lives amid the ice and snow of the frigid region, has as much warmth in his blood as has the African who lives under the scorching sun of the Torrid Zone. Men who work around great, hot furnaces, are no warmer inside their bodies than those who handle ice during the winter months.

Persons have been known to go for a few minutes, without harm, into ovens hot enough to bake bread. Years ago there was a man called the "Fire King," who could go into a very hot oven and stay five minutes. It was found that while he was in the oven the temperature of his blood was exactly the same as before he entered it.

Young girls in France who work in the bake shops, go into large, hot ovens in order to attend to the loaves of bread.

Now how is it possible for the body to be kept at the same temperature whatever the climate may be? Put a drop of cold water on the back of the hand, and you will feel the skin grow colder. Why is this? — The water, in evaporating, carries off the heat from the skin. In the skin are little openings, called pores, through which sweat oozes. As fast as the sweat escapes from the pores, it evaporates, and so cools the skin. Thus in health the temperature of the blood is kept from rising above its natural stage.

IN THE TROPICS

If the air outside is very cold, the pores contract, and very little sweat oozes out of them. Thus in hot weather, the abundant sweating tends to cool our bodies; while in cold weather, since little sweating takes place, the body does not lose so much heat. Is not this a wise arrangement? And the same wise Creator who has so arranged that the heat of our bodies shall not be affected by our surroundings, has also provided means for keeping our hearts warm with His love, even when we are among those who do not love and honor Him.

**Questions**

1. Why does the heat of the body remain the same always?
2. What is the normal temperature of the body?
3. One of the last great plagues is a plague of heat (Rev. 16: 8); but what has the Lord promised His people? Isa. 49: 10.

## CHAPTER III

# AIR AND SOUND

*(Scripture Basis, Gen. 1:6-8)*

*"And God said, Let there be a firmament in the midst of the waters."*

## Lesson X

### *The Atmosphere*

**Hast thou with Him spread out the sky, which is strong, and as a molten looking-glass? Job 37:18.**

There is an ocean of air surrounding the earth. It is called the *atmosphere*. This word is composed of two Greek words, the first meaning *vapor*, and the second, *globe*. The atmosphere extends upward more than forty-five miles above the earth's surface. Created upon the second day of the world's existence, and given a special work to do, the air has never been removed, nor has it ever been unfaithful to its duty.

The air is invisible, but it occupies space. It is more dense near the earth's surface than elsewhere; yet everywhere the particles of air are so light that they easily slip by each other, and are so easily pushed aside that we do not think of the air as being in the way at all.

Although so light a thing, the air can be weighed. A large glass globe full of air, when put on very fine scales, is found to weigh more than does the globe when the air has been pumped out of it.

The air is not felt when it is not in motion; but when the wind blows upon the face, it is felt in the same way that a wave of water is felt when it strikes one.

The atmosphere in motion does a great deal of work; but if the motion is too violent, it may do much damage. It is Satan's plan to misuse that which was intended only as a blessing.

### Questions

1. What is the atmosphere? Why is it so named?
2. What did God call the space occupied by the air? Gen. 1:6.
3. Describe the air.
4. How can the weight of air be found?
5. Of what is the air a sign, or symbol? John 3:8.
6. Mention work done by the atmosphere in motion.
7. What work was done by the air on the second day?
8. What title is given to the great enemy? Eph. 2:2.
9. Is Satan's power over the air absolute? Matt. 8:26.

### Note Book Requirement

On page 12 tell of the air and its work.

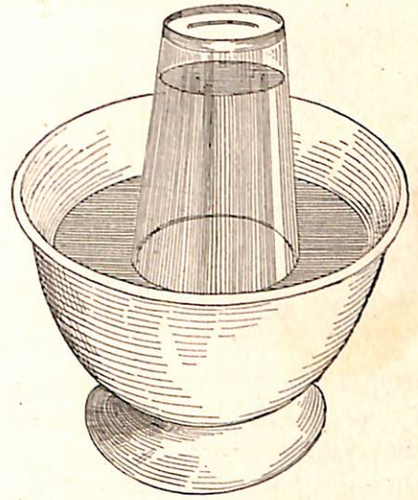


# Lesson XI

## *The Weight of Air*

For He [God] looketh to the ends of the earth, and seeth under the whole heaven; to make the weight for the winds. Job 28:24, 25.

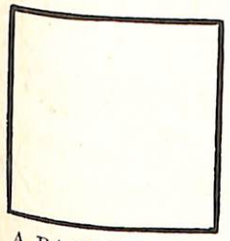
The air is everywhere, and it presses in every direction,— upward, and downward, and sidewise. If a hole is made in anything, the air at once rushes in, pressing this way and that, to fill it up. Large quantities of air can pass through the smallest crevice or crack.



THE AIR PRESSES DOWNWARD

The pressure of the air is due to its weight. By the use of scales, the weight of an object may be known; for it is exactly the same as that of the scale weights which balance the object.

The air will balance a column of water having a base of one square inch and a height of thirty-four feet. If a tube more than thirty-four feet in length, closed at one end and full of water, is placed with the open end in water, the water in the tube will fall until it reaches a level of thirty-four feet, at which it will remain. The air and the column of water just balance each other, and therefore their weights are equal. The



A BASE ONE INCH SQUARE

weight of the column of water is found to be about fifteen pounds, and hence the weight of air is about fifteen pounds to the square inch at sea level.

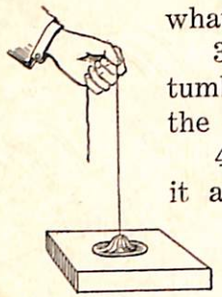
**Experiments**

1. Invert a tumbler, and place it in a pan of water. Does the water rise in the tumbler? Why not?

2. Tip the empty tumbler to one side, and notice what happens. Why does the water rise?

3. After the air has all passed out of the inverted tumbler, lift it almost out of the water. What makes the water stay in the tumbler?

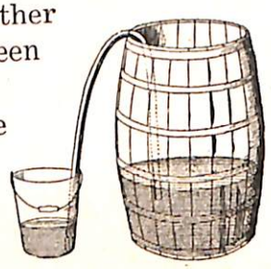
4. Fill a tumbler brim full of water, and place over it a sheet of paper. Place the palm of the hand over the paper and then quickly invert the tumbler. Remove the hand. Why does not the water run out of the tumbler?



THE AIR PRESSES DOWNWARD

5. Take a long glass tube closed at one end, and use it instead of the tumbler. Does the water remain in the tube? Why?

6. Take a round piece of soft leather, and to the middle of it fasten a string. Moisten the leather, and then press it evenly upon the smooth surface of a small stone or block of wood. If there is not a particle of air between the leather mat and the block, the block can be raised, as seen in the illustration. Why is this?



A SIPHON

7. To show how the pressure of air will make water run up hill, take a rubber hose and fill it with water. Place one end of the hose in a barrel of water, and the other in a pail of water. If the level of the water in the pail is below the level of the water in the barrel, the water will run from the barrel into the pail. If the level of the water in the pail is higher than the level of the water in the barrel, which way will the water run? Try this. It is the weight of the air on the surface of the water that lifts the water uphill, and it is because water is always trying to be level that it runs from the higher vessel into the lower.



**Note Book Requirement**

Explain air pressure as illustrated on page 13 and the first half of 14.

---

## Lesson XII

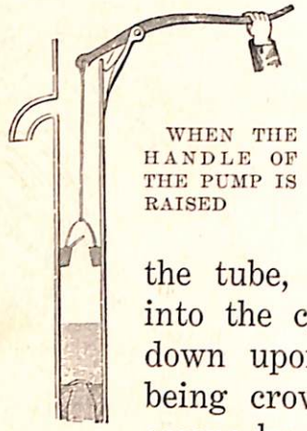
### *The Pump*

Water can not move itself, but must be moved by something else. When water is taken through a straw or tube, the air is first removed from the tube by *suction*. If the tube is a very large one, it may be necessary to draw several times to remove all the air; and as the air is drawn out, the water comes in, following close after the air. But the water does not of itself fill up the tube, neither is the water sucked up, as is sometimes said. As long as we keep the air out of the upper end of the tube, the air pressure upon the surface of the water in the vessel, holds the water up in the tube. Then if we draw all the air out of the tube, the outside air, which is all the time pressing on the water in the vessel, pushes the water up into the mouth.

A SIMPLE PUMP

This is exactly the way we pump water out of a well

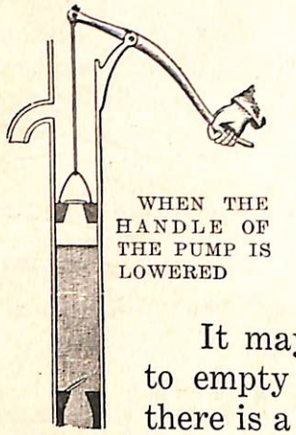
or cistern. The water is not *drawn* up, but is *pushed* up through the tube by the outside pressure of the air upon the surface of the water. First the air which the pump tube contains must be removed, and this is done by working the handle of the pump up and down.



WHEN THE HANDLE OF THE PUMP IS RAISED

When the handle is raised there is a *piston*, as it is called, let down into the tube, or *cylinder*. This piston fits closely into the cylinder, and when lowered it presses down upon the air in the tube; and the air, being crowded, and wanting more room, finds escape by means of a *valve* which opens upward in the piston.

When the handle is lowered, the piston is lifted in the cylinder; and the valve that before opened to let the air escape, closes again. The air that came above the piston has no chance to go back, because the moment the piston begins to move up, the air above the piston, pressing on the valve, shuts it. As the piston goes up, room is made below for the air that is in the pump tube to rise. The water follows the air, because of the outside pressure of the air upon the surface of the water in the well.

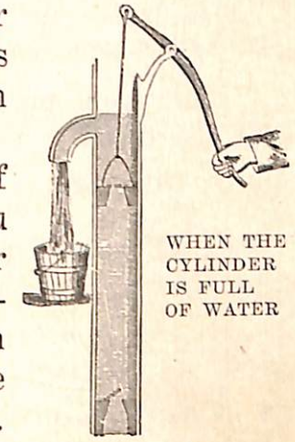


WHEN THE HANDLE OF THE PUMP IS LOWERED

It may take several movements of the piston to empty the cylinder and pipe of the air; but there is a lower valve in the pipe which also opens



upward, and this valve will allow none of the air that is pushed above it to return. The water follows immediately after the air; and when it gets above the valve, it can not go back. Then all the water that escapes through the upper valve, is lifted by the piston, and flows from the well.



WHEN THE CYLINDER IS FULL OF WATER

If a cistern or well were full of water and were also air-tight, you could not pump the water from it; for the water is *pushed up* instead of being *drawn up*. All that the piston in a pump does is to make room, and the pressure of the air forces up the water.

The weight of the air will lift the water from a well if the valve and piston are not at a greater distance from the surface of the water in the well than thirty-four feet.

**Spell and define**

| | | | |
|---|---|---|---|
| valve | pis′ ton | pres′ sure | han′ dle |
| suc′ tion | sur′ face | ves′ sel | cyl′ in der |
| tube | cis′ tern | con tain′ | ex tends′ |

**Note Book Requirement**

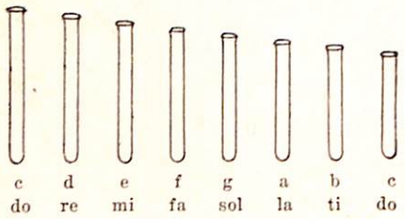
Explain the second illustration on page 14, and those on page 15.

# Lesson XIII

## *Musical Tones Produced by Wind*

**Praise Him with the sound of the trumpet: praise Him with the psaltery and harp. Ps. 150: 3.**

If it were possible to remove from the firmament all the air that it contains, and nothing were left in its place, this earth would be a sphere of silence. Even were life possible, no sound could be heard; for it is the vibration of the air particles that carries sound to the ear.




THE SCALE

The vibration of air in a tube or bottle produces a pleasant musical tone. The more rapidly the air is made to vibrate, the higher the pitch of the tone produced. The longer the tube or the bottle, the lower the pitch of the tone.

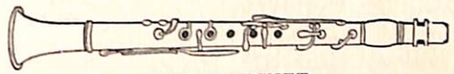
In all wind instruments, the tones are made by the vibration of the air in the tube. The air surrounding the instrument vibrates also. Waves of sound travel through the air to the ear, and thus the tone is heard.

THE FIFE

Reed instruments, as well as wind instruments, are operated by the air. In reed instruments there are thin wooden or metallic plates, called *reeds*. When the air is forced through the instrument, the reeds vibrate. The vibration of the reed sets the air in motion, and sound waves are produced.



The organ is a reed instrument. It has many metal reeds of various lengths. The air is forced into the organ by use of pedals, and the vibration of the reeds produces the tones. The longer the reed, the lower the tone produced; the shorter the reed, the higher the tone. Thick, wide reeds produce lower tones than do thin, narrow ones.



THE CLARINET

The fife, piccolo, and flute are examples of wind instruments having no reeds. The clarinet and the mouth organ are reed instruments. The clarinet has but one reed.

Both reed instruments and wind instruments were used in Bible times. Jubal was the father of all such as handle the harp and the organ; and, as far as we know, he made the first musical instrument.

**Spell and define**

si′ lence
in′ stru ment
me tal′ lic
pitch
pic′ co lo
va′ ri ous
par′ ti cles
vi bra′ tion
clar′ i net

**Questions**

1. Of what use is the air in making sound possible?
2. How is sound carried to the ear?
3. What three sound instruments are pictured on pages 16 and 17 of the "Nature Note Book No. 2"?
4. To what class of sound instruments do these belong?
5. How do reed instruments differ from wind instruments?
6. Name wind instruments with which you are familiar.
7. How is sound produced in a wind instrument?
8. How is it produced in a reed instrument?

9. Upon what does pitch depend in a wind instrument?
10. Upon what does pitch depend in a reed instrument?

**Note Book Requirements**

1. Write answers to the above questions on pages 16 and 17 of the Note Book.
2. Draw pictures of familiar wind instruments on page 17.

---

### A PSALM OF PRAISE

O sing unto the Lord a new song; for He hath done marvelous things: His right hand, and His holy arm, hath gotten Him the victory.

The Lord hath made known His salvation: His righteousness hath He openly showed in the sight of the heathen.

He hath remembered His mercy and His truth toward the house of Israel: all the ends of the earth have seen the salvation of our God.

Make a joyful noise unto the Lord, all the earth: make a loud noise, and rejoice, and sing praise.

Sing unto the Lord with the harp; with the harp, and the voice of a psalm.

With trumpets and sound of cornet make a joyful noise before the Lord, the King.

Let the sea roar, and the fullness thereof; the world, and they that dwell therein.

Let the floods clap their hands: let the hills be joyful together

Before the Lord; for He cometh to judge the earth: with righteousness shall He judge the world, and the people with equity.

## CHAPTER IV

# WATER

*(Scripture Basis, Gen. 1:9, 10)*

*"And God said, Let the waters . . . be gathered together unto one place."*

## Lesson XIV

### *Distribution of Water*

**By His knowledge the depths are broken up, and the clouds drop down the dew. Prov. 3: 20.**

Gushing forth in springs, rippling along in brooklets, plunging in cataracts down the mountain side, moving silently along in the broad, deep rivers, tossing and rolling in the mighty, restless sea, another of God's untiring agencies is ever at work. Whence all this water supply, and whither?

It is God who distributes water over the dry, thirsty land, and the ocean is His great reservoir of moisture.

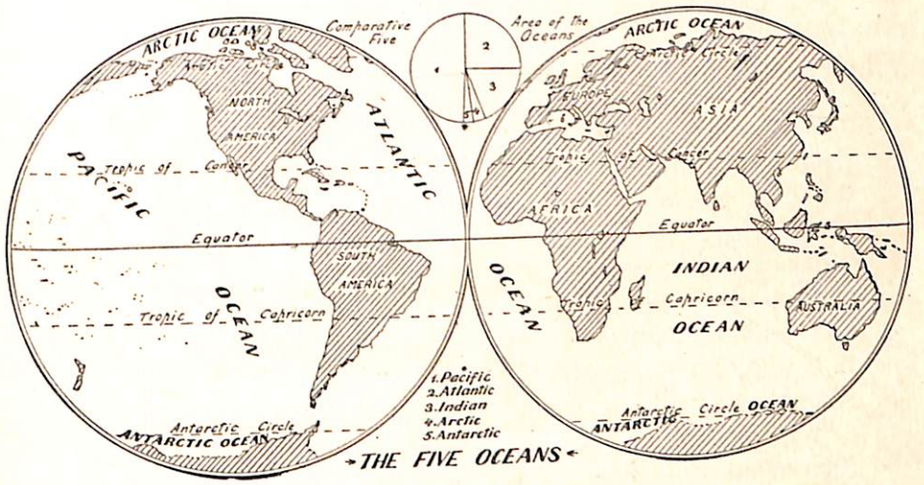
But how does He lift and distribute this moisture? It would be impossible for man to build machinery gigantic enough to lift from the ocean sufficient water for the world's needs. It would be impossible for man-made machinery to carry this immense amount of water through the firmament, and then arrange to have it brought again to earth. Marvelous, in truth, is God's wisdom, and marvelous His power. The agencies that He created in the beginning are still faithfully at work, making possible our supply of moisture, our river systems, navigation, and the attractive scenery of lake shore and ocean beach.

NEVADA FALLS, YOSEMITE VALLEY

Water vapor, collected by the heat rays, is held above the earth in clouds. These clouds are moved along by the air until they can no longer carry their weight of moisture. In this way the dry land is watered by the clouds, God's great water carriers; and the raindrops, falling to earth, begin immediately to hunt their way back to their home, the great sea.



The sea, spreading itself over three fourths of the earth's surface, surrounding continents as well as islands, cutting out harbors, and reaching great arms far into the dry land, swallows up all the great rivers in all parts of the world; and yet these rivers are but as a drop in the bucket, and are quickly lost in the briny deep. Into how many parts, or oceans, is this deep divided? What is the division around the North Pole called? By what




name is the water around the South Pole known? Concerning these two oceans very little is known; for they are blocked with floating ice the greater part of the year.

What ocean extends from the Arctic Ocean to the Antarctic Ocean, having the Old World on the east and the New World on the west? Across this ocean Columbus and others came in ships to the Americas; and although a stormy ocean, it has ever since been much traversed by vessels. It takes about a month to go from America to

Europe in a sailing vessel, but on a steamer the trip may be made in less than one fourth of this time.

Men who first sailed around into the waters of the quiet Pacific Ocean, gave to this great body of water a name which means peaceful. This ocean lies west of what continents? How does it compare in size with the other oceans?

There is still another great division of the sea. It lies south of India, between Africa on the one side and Australia on the other. It is noted for its terrible storms. What is its name?

**Questions**

1. How important is water in God's great scheme?
2. When and how did the Creator first speak to the waters? and what was the result? Gen. 1: 9, 10.
3. What previous command had divided "the waters from the waters"? Gen. 1: 6.
4. How did the first three commands of the creation week provide a plan for watering the earth?
5. About what proportion of the earth's surface is now covered with water?
6. Into what five great parts is the sea divided?
7. Name the oceans in order of size.
8. Locate the oceans, and tell something about each.
9. What is a gulf?
10. What other names are given to the great arms of the ocean?
11. What is a spring? a lake? a river?
12. Explain what the wise man says in Eccl. 1: 7.

**Note Book Requirements**

1. On page 18 draw a ship, and write a story about the great ocean, stating your impressions concerning it.
2. Collect pictures of beach and ocean scenery.



# Lesson XV

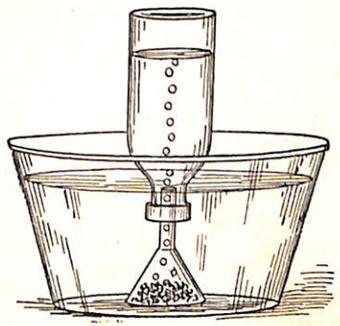
## *The Composition of Water*

**Jesus answered and said unto her, If thou knewest the gift of God, and who it is that saith to thee, Give Me to drink; thou wouldest have asked of Him, and He would have given thee living water. John 4:10.**

Like air and all other substances, water occupies space and has weight. Unlike air, water is a visible substance; but, like air, pure water is odorless and tasteless.

WATER ANALYZER

Water is composed of two invisible gases. It can be separated into these two gases by passing through it an electric current. If two tubes are filled with water, and then inverted, as seen in the water analyzer, the gas called *oxygen* will collect in one tube, and gas called *hydrogen* will collect in the other tube. Twice as much space is occupied by the gas in the hydrogen tube as by the oxygen in the other tube; for the hydrogen tube will collect twice as much gas in a given time as the oxygen tube.


COLLECTING OXYGEN FROM PLANT

Hydrogen gas is colorless, tasteless, and odorless. It is sixteen times lighter than oxygen. To keep hydrogen from flying away, the bottle is kept upside down. Hydrogen will put out a flame, but will burn at the base of the bottle where the oxygen in the air unites with it.

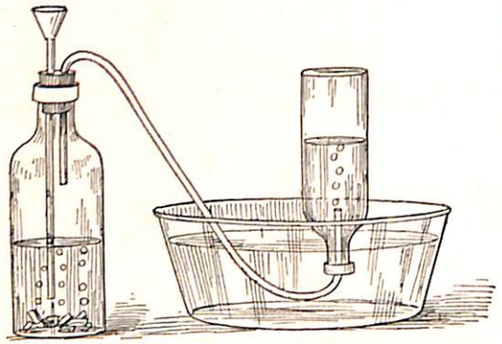
The oxygen in the water is the same as that in the air. It is the gas which unites with all burning substances; and if the air were pure oxygen, iron would burn as readily as wood now burns. Only one fifth of the air is oxygen. This gas is thrown off by plants, and may be collected as shown in the illustration.

**Spell and define**

| | | |
|---|---|---|
| sub′ stance | vis′ i ble | el e men′ ta ry |
| hy′ dro gen | col lect′ ed | o′ dor less |
| ox′ y gen | sep′ a ra ted | taste′ less |
| brisk′ ly | e lec′ tric | col′ or less |
| an′ a ly zer | cur′ rent | oc′ cu py |

**Experiments to Be Performed by the Teacher, before the Class**

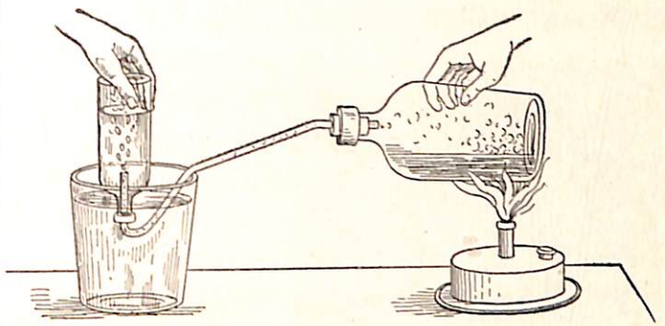
1. Fill a bottle with water, and invert it over a vessel of water. Into another bottle put some zinc filings, attaching a rubber tube to the glass tube that passes through each cork. First completely cover the zinc filings with water, and then pour into the bottle an equal quantity of hydrochloric acid. Immediately bubbles of hydrogen will escape, passing through the rubber tube and displacing the water in the inverted bottle. This is because the hydrogen in the acid is set free and passes off as a gas. The chlorine in the acid leaves the hydrogen and unites with the zinc. Test this gas for hydrogen.



PREPARING HYDROGEN

2. Fill a bottle with water and invert as before, over a basin of water. In another bottle place a mixture of potassium chlorate and manganese dioxide. Adjust a stopper with a tube leading into the mouth of the inverted bottle. When heat is applied to the mixture of potassium chlorate and manganese dioxide, the oxygen in the potassium chlorate escapes, and passing through the tube, displaces the water. Test this gas for oxygen.





PREPARING OXYGEN

3. With forceps hold one end of a picture-cord wire or a steel shaving in a flame for an instant, then dip it into a bit of powdered sulphur. Hold it again in the flame till the sulphur burns, then put it into a jar of oxygen. A little water in the bottom of the jar will prevent breaking. If the iron does not burn, repeat with another jar of oxygen. Have but little sulphur on the wire.

**Note Book Requirement**

Explain illustrations found on pages 19 and 20 of Note Book.

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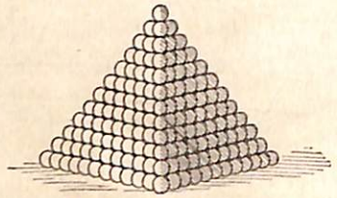
## Lesson XVI

### *Habits of Water*

**He weigheth the waters by measure. Job 28: 25.**

How easily the particles of water glide upon each other! The particles of a solid cling very closely to one another; but those of a liquid are easily separated. A mere touch will break up the particles of a drop of water or other liquid.

If we compare these particles of a fluid to exceedingly fine, smooth balls, we can understand why they move upon each other so easily, and why water is always trying to be level. If you look at balls of shot lying side by side, you will see that unless the shot are unusually rough, and unless the surface upon which they are placed is also rough, it will not be possible to pile a second layer upon the first. Each shot will attempt to get down between its neighbors, and thus will spoil the pile. The smoother the shot, the more easily they will roll, and the more difficult it will be to pile the balls upon one another.



PYRAMID OF SHOT

Just so it is with water. In all its motions the water is trying to keep level. Water that is level will not run; but whenever the level is disturbed, the water will begin to run, and it will run until it finds its level. This tendency of water to keep level is what causes brooks and rivers to flow on and on, ever gladdening man and beast with their clear, pure waters. It is this habit of trying to be level that will cause water to rise to a level with the spring or reservoir, on the hillside, from which it may be brought in pipes. In this way, when the level of the water in the fountain or

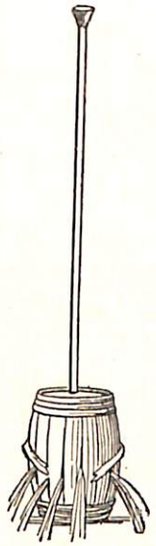
WATER SEEKING ITS LEVEL



reservoir is sufficiently high, the upper stories of high buildings can be supplied with water without difficulty. It is the effort of the water to be level that makes the fountain and the artesian well burst in a strong stream from the earth, spread out, and drop in a shower all around. The source of the fountain and of the artesian well is always higher than the surface of the earth from which it rises.

ARTESIAN WELL

The water spouts from an opening near the bottom of a vessel or pipe with greater force than it does from an opening near the top. This is because the particles of water near the bottom of the vessel have more pressure upon them than the particles near the top of the vessel, and, like a throng of eager people crowding through a small door, they are pushed through the opening with much more force than if there were but few particles to push. The great pressure of water can be seen by pouring water into a long, upright tube which is connected with the closed head of a keg or barrel. If the tube is long enough, the pressure of the tall, slender column of water will be sufficient to break through the sides of the barrel. But the *quantity* of water that there is in a vessel has nothing to do with the amount of pressure. It is the *height of the water above the opening* that

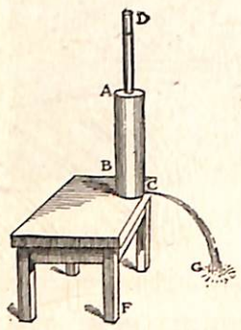


WATER PRESSURE

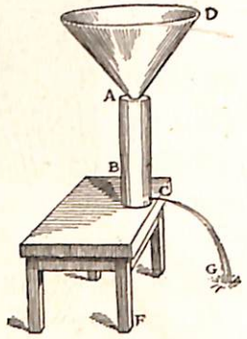
is important. The same amount of water poured into a wider vessel would not show such great pressure.

**Experiments**

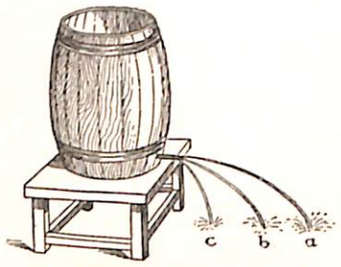
1. If you have a water tank with the tap at the bottom, fill it with water. When you turn the tap what happens? Mark the




ADDED PRESSURE FROM SMALL TUBE




ADDED PRESSURE FROM FUNNEL




DIMINISHING PRESSURE

distance to which the pressure of the water forces the stream. As the water diminishes in the tank notice how the pressure diminishes.

2. Insert through an opening in the top of a water tank or other closed vessel a slender tin tube. Fill both the tank and the tube with water. Notice when the tap at the bottom of the tank is turned to what distance the water spouts. Measure the distance. Now, remove the tin tube and instead put on the top a large funnel. Pour water into the funnel, filling it to the same height as the length of your tube. Of course the funnel will hold many times as much water as the tube, but if the water stands in the funnel no higher than it stood in the tube what will you expect to find when you turn the tap as before?

**Note Book Requirement**

Write a story upon the pressure of water, and copy it on page 21.



# Lesson XVII

## *Water as a Liquid*

Sing unto the Lord with thanksgiving; sing praise upon the harp unto our God: who covereth the heaven with clouds, who prepareth rain for the earth, who maketh grass to grow upon the mountains. Ps. 147: 7, 8.

The liquid which we call *water* has a large place to fill in God's great plan. Dew, mist, and rain are common forms of liquid water; and without these vegetation would become parched, and all life would perish. Springs, brooks, creeks, lakes, and rivers, would soon dry up, and even irrigation would be impossible if moisture were not continuously distributed over the face of the earth in the form of liquid.

AN IRRIGATING DITCH

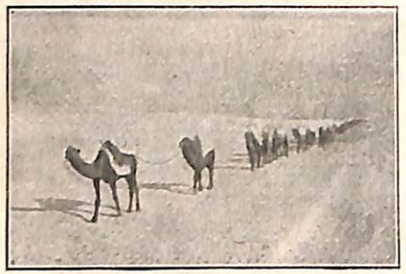
Water is pumped from a well or is turned into the irrigating ditch from a large brook or river.

GOD'S WATER CARRIERS

Heat and air are agents God employs for distributing moisture over the face of the earth. "When He uttereth His voice, there is a multitude of waters in the heavens, and He causeth the vapors to ascend from the ends of the earth; He maketh lightnings with rain, and bringeth forth the wind out of His treasures." You have already learned

that the ocean is the great reservoir of moisture. You have learned that as the sun shines upon the great expanse of water, the liquid is turned into vapor. The vapor, being lighter than air, is lifted up and held in the atmosphere, and may be blown landward.

There the moisture-laden clouds, becoming chilled, drop their moisture, perhaps hundreds of miles inland. Persons living where there is plenty of rain, do not always realize what a blessing it is, and how very important is the work done by the falling rain, the quiet mist, and the gentle dew; but those parts of the earth where but little moisture falls, are known as *desert*. In such regions only a few kinds of plants and animals can live; and the weary traveler sees little attraction in the parched and desolate plains.



IN A DESERT REGION

The desert is a reminder of sin and the curse. Just as the traveler upon the desert "urges his failing steps to the cool shade and the life-giving water," so God's children may hasten to Jesus for the "water of life." None need perish in the desert of sin; for Jesus invites all who thirst, to come to Him.

The cooling of the earth at night chills the moisture in the atmosphere, and little drops of water form upon the grass and herbs. This is *dew;* and the blessing it brings to vegetation is likened in the Bible to the work of the gospel.



The prophet compares also the word of God, and the effect it produces, to rain. The visiting of God's people with the Holy Spirit is compared to rain. Our Father promises to refresh His people, and to cause them to thrive, even as He causes the lily to grow in all its beauty.

**Questions**

1. Name and define the common forms of liquid water.
2. By what agencies is moisture distributed?
3. Define a spring, a brook, a creek, a river.
4. Is the rainfall equally distributed? (Notice map.)
5. Define irrigation, and state its benefits.
6. Of what is liquid water a symbol?
7. Upon whom does God send blessings? Matt. 5: 45.
8. Of what is the desert a symbol?
9. Tell what you know of the River of Life.

**Note Book Requirements**

1. Copy on page 23 of the Note Book the definitions given in answer to questions one, three, and five.
2. Find a poem describing brooks or rivers and copy it on page 24 of Note Book.
3. Collect pictures of brooks, rivers, and oceans, and notice as many things as you can about them.
4. Read the following texts, and copy them into your Note Book: Jer. 10: 13; Deut. 32: 2; Isa. 55: 10, 11.

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## Lesson XVIII

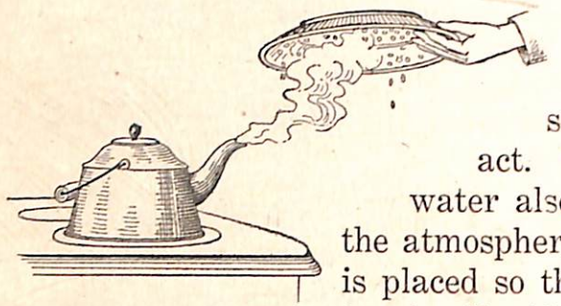
### *Vaporized Water*

**He causeth the vapors to ascend from the ends of the earth. Ps. 135: 7.**

Some of the common forms of vaporized water are *steam, vapor, cloud,* and *fog.* These forms are all pro-

duced by heat; because heat, causing water to evaporate, changes it from a liquid into a gas. This water gas, which is lighter than air, becomes chilled, and is seen as vapor, fog, or clouds. Steam is never seen, because it is invisible; but chilled water gas is always visible.

Most of the vaporized water above the earth's surface is formed over the oceans. Here the heat has much water surface upon which to act. Large inland bodies of water also furnish moisture for the atmosphere, and wherever water is placed so that heat may act upon it, the liquid disappears in vapor.



STEAM IS INVISIBLE.
WHAT WE SEE IS VAPOR.

More vapor arises from warm water than from cold water, and warm air can hold more moisture than can cold air. There are warm currents of water flowing through the ocean. The *Gulf Stream* is one of these, and the *Japan Current* is another. Much vapor is constantly arising from these warm currents.

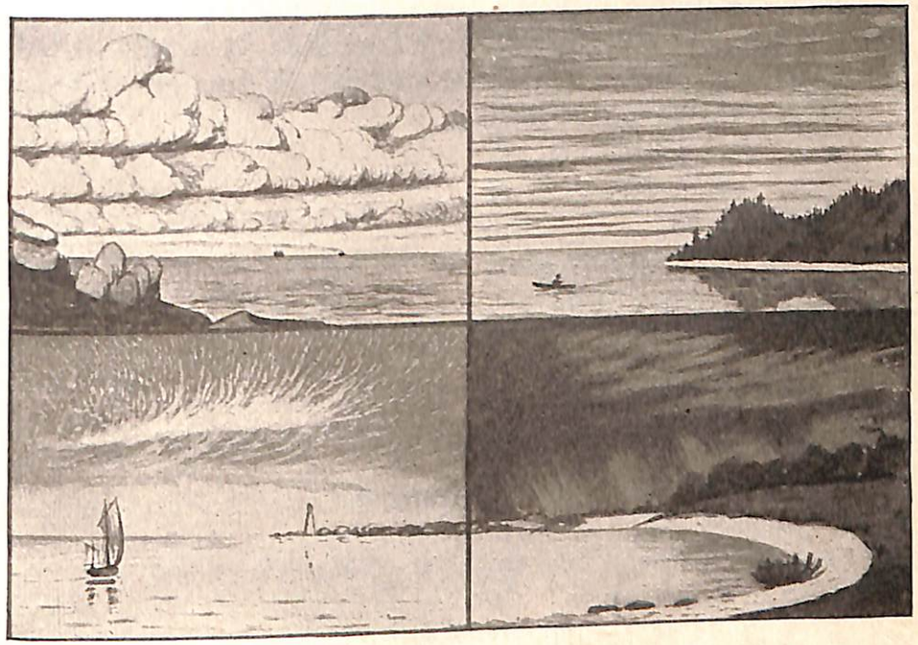
If this moisture becomes chilled at once, the vapor hangs low upon the water's surface, and we call it *fog*. A wind may carry the moisture along; and if it becomes chilled as it travels, it may hang low above the earth's surface, covering valley and plain with a thick mantle. This is known as *mist*, or *fog*.

If, however, the vapor arising from water does not become chilled until it has been lifted high overhead, we then call the chilled moisture *clouds*. These are also



pushed along by the moving air. Clouds are, on an average, about two and a half miles above the earth's surface.

The *cirrus*, or curl cloud, looks like long curls of white,



FORMS OF CLOUDS

Cumulus
Cirrus
Stratus
Nimbus

woolly hair. It is highest of all clouds, and is supposed to consist of snowflakes.

The *stratus* is a cloud arranged in straight, white bands, and is generally seen at sunset.

The *cumulus* has the appearance of rounded hills covered with snow. These are piled one above another.

*Nimbus* is the rain cloud, and is dense, heavy, and black.

God's voice is heard in the cloud. He speaks to us of His love and care in the cloud as well as in the sunshine. Just as God sends the cloud across the bright sky, so He sends clouds into the lives of His children. Every sorrow or trial that is allowed to come, is really filled with blessing; and when the cloud passes, we can better appreciate the bright sunshine.

**Spell and define**

| | | | |
|---|---|---|---|
| e vap′ o rate | nim′ bus | stra′ tus | fog |
| vap′ o rized | va′ por | mist | cloud |
| cu′ mu lus | cir′ rus | steam | dew |

**Note Book Requirements**

1. On page 26 indicate rainfall on Mercator's projection.
2. On same map place the two warm ocean currents mentioned in the lesson.
3. On page 27 illustrate and describe the most beautiful clouds you have ever seen, telling what your impressions are as you watch the clouds, and what lessons they teach you.

---

## Lesson XIX

### *Water as a Solid*

**Hast thou entered into the treasures of the snow? or hast thou seen the treasures of the hail, which I have reserved against the time of trouble, against the day of battle and war? Job 38: 22, 23.**

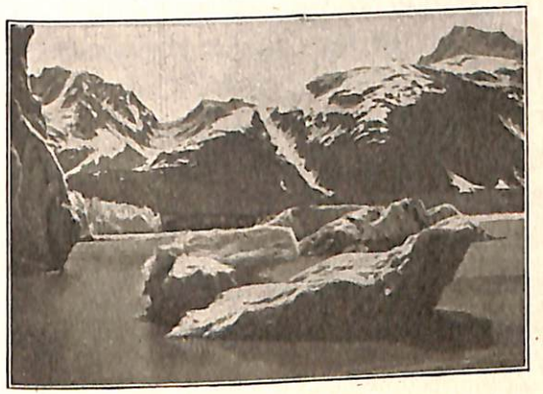
*Snow* and *hail* are solid forms of water. *Ice*, *sleet*, and *frost* are also forms of water when it is in a solid condition. Water will freeze at a temperature of 32 degrees F., and when vapor condenses at a temperature



below this point, it will not fall to earth as a liquid, but as a solid.

If the vapor is high above the earth, its particles may become chilled and freeze into crystal *snowflakes* as they descend earthward. This happens before the vapor particles have time to condense and fall as raindrops. If, however, the vapor condenses into drops of water before it freezes, these frozen drops of water may reach the earth as *hailstones*. The size of the hailstone depends upon the number of drops frozen into one lump. In calm weather a single drop of water may form a single hailstone; but when the wind blows, many of them are blown into one, and they fall as larger lumps of ice.

A WINTER SCENE



THE SNOW LINE IN ALASKA

*Sleet* is nothing but snow that is driven about by the wind, or that falls through a layer of warmer air and is partly melted before reaching the earth.

At night, if the temperature is below freezing point, the water vapor, instead of condensing into drops of dew, forms fine spikelets of ice, and covers everything with what we call *frost.*

WASTING SNOWDRIFTS IN THE SIERRAS

The higher up one goes, the cooler is the air; and in mountainous regions one may reach a height above which moisture never falls as rain. In the Temperate Zones the line of perpetual snow is not so many thousand feet above the sea level as it is in the Torrid Zone; but even in tropical lands the highest mountain peaks are crowned with perpetual snow. In the Frigid Zones, the snow line is nearly at the sea level; and in such countries as Alaska the scenery is very impressive, for a low snow line makes the mountains beautiful. In warmer countries, snow-topped mountains are great reservoirs of moisture; for they supply water during the long, dry summer, to be used oftentimes for the irrigation of arid lands in the plains or valleys below.

If no snow fell in winter in those regions where it now falls, the ground would be frozen hard, and few seeds could live in it; but the snow covers the earth like a blanket, and hence the ground is not



frozen so deep but that the seeds have a chance to live. Probably you have learned already that all snow crystals are six-sided; and doubtless you have seen pictures of the light, feathery, beautiful flakes.

The snow is a symbol of purity and cleanliness. David prayed, "Wash me, and I shall be whiter than snow;" and Jesus has promised, "Though your sins be as scarlet, they shall be as white as snow." Thus, as the silent flakes descend earthward, as they cover from sight all that stretches about us, they teach us to look to Jesus for the robe of righteousness which He has promised to all who desire it, and with which He intends all His children shall be eternally clothed.

"He [God] giveth *snow* like wool: He scattereth the *hoar frost* like ashes. He casteth forth His *ice* like morsels: who can stand before His *cold?*"

**Spell and define**

| | | | |
|---|---|---|---|
| con dense′ | ar′ id | hail | ice |
| trop′ ic al | frost | snow | sleet |

**Note Book Requirement**

On page 28 copy Ps. 147: 16, 17; and Isa. 1: 18. Collect pictures to illustrate the water forms mentioned in this lesson, and use these to illustrate the Bible texts.

---

## Lesson XX

### *Water as a Beverage*

**Look not thou upon the wine when it is red, when it giveth his color in the cup, when it moveth itself aright. At the last it biteth like a serpent, and stingeth like an adder. Prov. 23: 31, 32.**

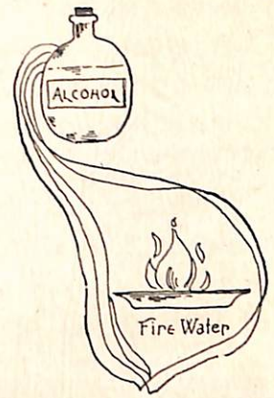
Thirst is the call of the body for water, and there is no other drink that can answer this call. The blood and all the fluids of the body contain water, and every part of the body needs it. In fact, nearly three fourths of the weight of the body is made up of water.

WATER AS A BEVERAGE

Water alone will prolong life for a time. Men have succeeded in living forty days or longer without taking any other food or drink than water. There is a well-known case of a miner who lived twenty-three days buried in a coal mine, without swallowing anything but water sucked through a straw. The water contained in foods makes them easy to digest. Certain foods, as lettuce, cabbage, apples, and potatoes, are more than three fourths water.

In warm weather the body needs more water than in cold, but ice water used in large quantities often leads to serious results. When taken, ice water should be sipped slowly, a little at a time. Pure water is our natural drink. The body requires no other beverage. Artificial drinks — tea, coffee, and fermented drinks — are all harmful. Strong tea will weaken the action of the heart, and produce what is known as "tea-drinkers' heart." Alcohol is a poison; and when taken into the blood, it will injure health and destroy life.






Alcohol looks like water, but its nature is very different. Water poured on a plant causes it to grow and thrive; alcohol poured on a plant kills it. A fish, which lives all its life in water, would die at once if put in alcohol. Water softens food and helps it to digest; alcohol hardens many kinds of foods. No part of the body needs alcohol. It produces a hot feeling in the mouth, and so creates thirst instead of quenching it. Alcohol robs the blood of water. It is well called "the water of death," whether it is taken as beer, ale, wine, cider, rum, whisky, brandy, or any other drink.

**Spell and define**

| | | | |
|---|---|---|---|
| bev′ er age | kid′ neys | di gest′ | quench |
| ar ti fi′ cial | al co hol′ ic | in′ jure | food |

**Experiments**

1. Pour a little alcohol in a basin, and touch it with a lighted match. What happens?

2. Put a little of the white of an egg into alcohol. What happens to the egg?

**Questions**

1. What is thirst?
2. Why does the body need water?
3. Is there any drink that will take the place of water?
4. Name drinks that contain alcohol.
5. Why are artificial drinks harmful?

**Note Book Requirements**

1. On page 29 answer the foregoing questions.
2. Compare a glass of alcohol and a glass of water.

# Lesson XXI

## *Water as a Cleanser*

**Purge me with hyssop, and I shall be clean: wash me, and I shall be whiter than snow. Ps. 51: 7.**

Water cleanses and refreshes the body outside and inside. The skin, which covers the body so closely, and yet is so elastic that it yields to every movement, is one of the outlets by which the body gets rid of its waste.

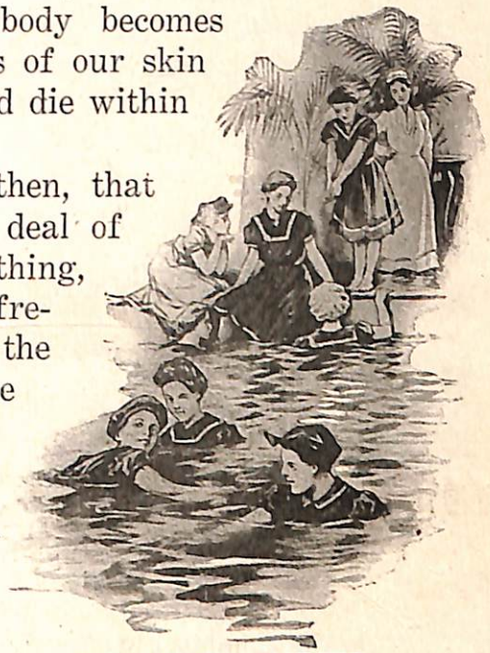
WASHING IN JAVA

We know that the outer skin consists of a countless number of little scales laid one above another, somewhat as several layers of shingles are put on a house. Below this outer skin there is a very delicate true skin filled with blood vessels and nerves.

If we look closely at the skin on the tips of the fingers, we can see a great number of little openings. These openings are called *pores*. All over the body we find these tiny mouths. They are the openings of the sweat glands, which lie just beneath the outer skin. These sweat glands are tiny tubes into which the blood strains certain waste matter. This waste matter rises in the sweat glands until it oozes out of the openings, where it is called sweat, or *perspiration*. Thus the sweat glands serve as little drain pipes to rid our bodies of waste matter.



About two pints of sweat flow every day through these little waste pipes. If for any reason the sweat glands are not able to do their work well, the blood must retain the waste matter, and the body becomes poisoned. If all the pores of our skin were stopped up, we should die within a few hours.



A HEALTHFUL EXERCISE

How necessary it is, then, that we keep clean. A great deal of sweat soaks into our clothing, which, therefore, needs frequent washing. Some of the waste matter clings to the skin, and, together with the dust from the outside, makes a little plug, as it were, over the pores. Many people think they have done quite enough if they wash their hands and faces every day. But it is just as necessary to wash the entire body. Swimming has a wholesome effect upon the skin, and is a healthful exercise, if due care is taken to avoid chilling and other dangers. No kind of bath should be taken within two or three hours after eating, nor when overheated.

When we see how important water is as a cleanser, we can understand why Jesus calls His words, and the salvation they contain for each of us, "the water of life." His word is free to all, and will cleanse from every im-

purity. Just as we need water to cleanse our bodies, so we need the word to cleanse our hearts.

**Note Book Requirements**

1. Write three paragraphs telling why we need clean bodies, clean clothes, and clean hearts. Copy on page 22 of Note Book.
2. Copy Ps. 51:7 and John 15:3 on the same page.

---

### WATER, PURE WATER

"Water, pure water, that sparkles so bright,
Beautiful, fresh, and free,
Falling from heaven like jewels of light,
Falling for you and me,
Fresh from the bountiful Giver of all,
Nothing so pure can be;
This is the song of the showers that fall
Over the lake and lea:—
Drink water, pure water!
Drink water, pure water!
Drink,
Drink,
Drink,
Drink,
Drink pure water!"

## CHAPTER V

# DRY LAND

*(Scripture Basis, Gen. 1:9, 10)*

*"And God said, . . . Let the dry land appear."*

## Lesson XXII

### *Review Study of the Land Masses*

**O give thanks to the Lord of lords: . . . to Him that stretched out the earth above the waters. Ps. 136:3, 6.**

1. Of what does the earth's surface consist?
2. How and when did God cause dry land to appear?
3. What proportion of the earth's surface is land?
4. What are the great bodies of land called? Name them.
5. Which is the largest continent? Which is the smallest?
6. What is a hemisphere?
7. Name the continents in the Western Hemisphere.
8. Name the continents in the Eastern Hemisphere.

9. Notice which hemisphere has the larger amount of land, and how the land is distributed on each.
10. Notice which pole has the more water near it.
11. What are continental islands? Name several groups of continental islands.
12. Do you see any wisdom in the Creator's arrangement of the land and water masses upon the globe?

**Note Book Requirements**

1. Write answers to the above questions on page 30 of Note Book.
2. On map No. 1, page 31, (a) print "North," "South," "East," and "West" upon corresponding sides of the hemispheres; (b) indicate which one is the Eastern Hemisphere and which the Western Hemisphere; (c) color the water surface, and name each grand division of the great sea; (d) name the grand division of land lying within both hemispheres; (e) locate the Equator, North Pole, South Pole, Tropic of Cancer, and Tropic of Capricorn.

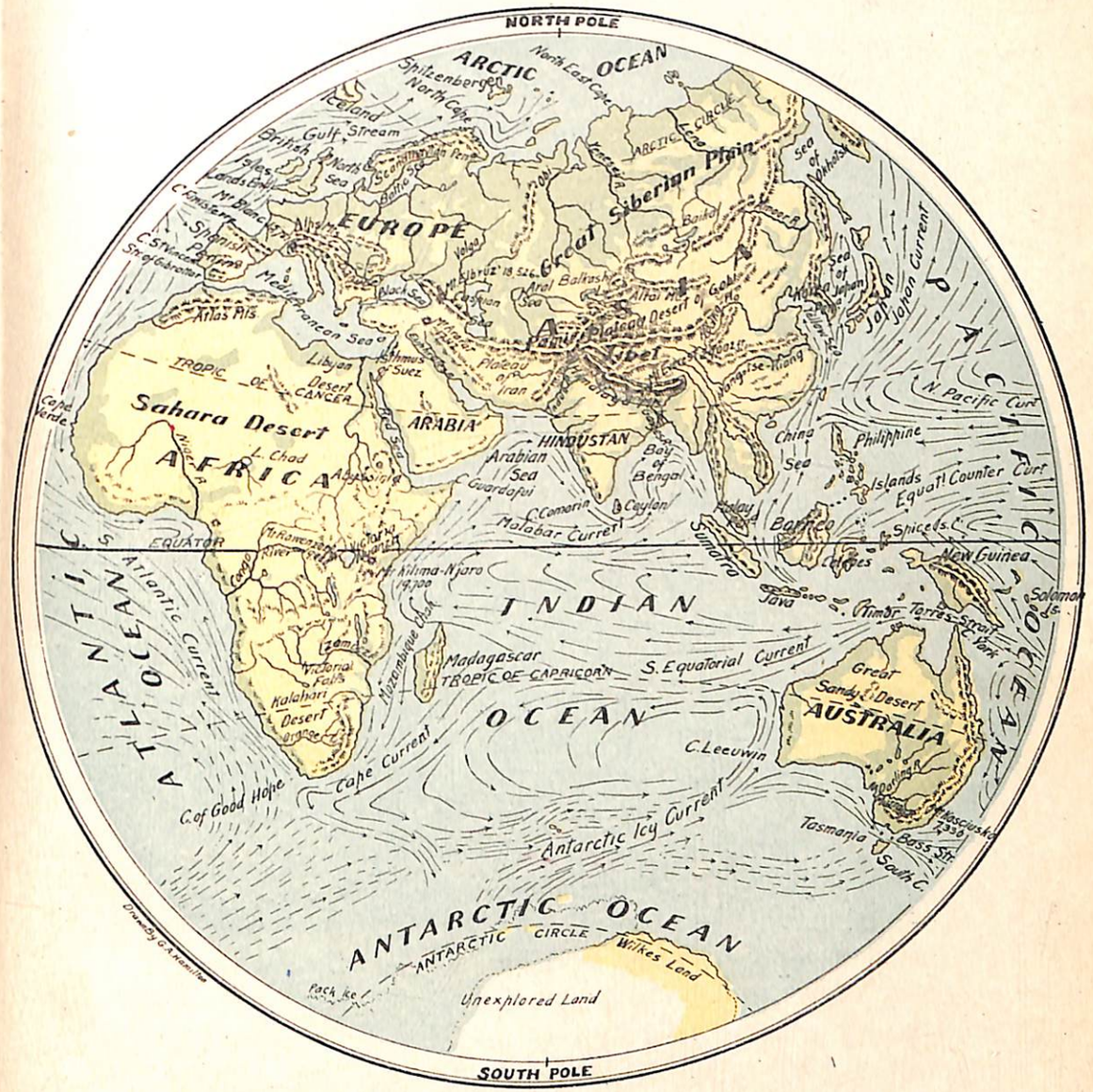
---

## Lesson XXIII

### *A Glance at the Eastern Hemisphere*

**Thou hast set all the borders of the earth. Ps. 74:17.**

Of the four continents situated in the Eastern Hemisphere, *Asia* is by far the largest, containing more than one third of the land surface of the world. Asia is the continent that cradled mankind in the beginning, and it was upon this continent that the Lord planted that first home, the garden of Eden, which was afterward removed from the earth.



*Europe* is but one fourth the size of Asia, and is really but a peninsula of that great continent, being called a separate continent only for convenience. The boundary between Asia and Europe follows a series of land depressions once occupied by a channel of water which connected the Mediterranean Sea with the Arctic Ocean. The Caspian Sea and the Black Sea are in the line of depression, and lie between these two continents. Although the smallest continent in the world, except Australia, Europe has far more inhabitants in proportion than any other continent on the globe. The Lord said He would enlarge the borders of Japheth; and we find that it was Japheth's descendants that journeyed westward into Europe and multiplied upon this continent.

THE BOSPORUS — A NARROW STRAIT

GIBRALTAR

Guarding the Atlantic entrance to the Mediterranean.

*Africa*, the second largest continent in the world, is connected with Asia by a narrow neck of land known as the Isthmus of Suez. It is separated from Europe by the Mediterranean Sea, and by a strait only eight miles wide — the Strait of Gibraltar. Although Africa was

known to the people of Europe long before the Western Hemisphere was discovered, yet less is known about it than about any other continent. It is often called the Dark Continent. We shall learn reasons for this name as we learn more about the surface, the climate, and the people of this great body of land.

HONGKONG — A CHINESE HARBOR

The coast line of both Asia and Europe is very irregular, having many large peninsulas bordering on gulfs or seas. Along the eastern and southeastern coast of Asia are many large islands, some distance from the shore, which divide the western portion of the Pacific Ocean into a number of seas nearly surrounded by land. Between Asia and Australia the islands are very numerous, forming what is sometimes called the *Malay Archipelago*. An irregular coast line provides excellent harbors. Both Europe and Asia are fortunate in this respect.

STOCKHOLM — A HARBOR ON THE BALTIC SEA

Australia is the smallest of all the continents. Being surrounded by water it is entirely separated from the other continents. Both Australia and Africa are comparatively regular in outline, and therefore have but few good harbors.



The continents of the Eastern Hemisphere extend from the North Frigid Belt through the North Temperate, the Torrid, and into the South Temperate Belt. But we shall see that the climate is variously modified by mountains, ocean currents, and winds.

### Questions

1. What is an archipelago?
2. What is a peninsula?
3. What is an isthmus?
4. Name three peninsulas of Europe; three peninsulas of Asia.
5. What is a cape?
6. Locate three capes belonging to Africa; two, to Asia; two, to Europe.
7. Locate all the seas mentioned in the lesson.
8. Locate Gibraltar; the Bosporus Strait.

### Note Book Requirements

1. On map No. 2, page 32, print "North," "South," "East," and "West."
2. Locate upon the Eastern Hemisphere all the divisions of land and water mentioned in the lesson.
3. Locate the zones and their boundaries.
4. Color the Torrid Zone red, the Frigid Zones blue, and the Temperate Zones yellow.

# Lesson XXIV

## *A Glance at the Western Hemisphere*

I fear the Lord, the God of heaven, which hath made the sea and the dry land. Jonah 1: 9.

There are but two continents in the Western Hemisphere — North America and South America.

Until near the close of the fifteenth century after Christ the people of the Eastern Hemisphere did not know that these continents existed. The centuries just before that time are known as the Dark Ages, because of the ignorance of the people. But as men began to think and reason and travel more, Columbus, whose home was in Europe, came to believe that the world is round, and that by sailing directly west, he would reach India, which Europeans had formerly reached by going east. He did not know that great continents lay between Europe and India. Since that mem-

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A WESTERN HARBOR OF THE OLD WORLD

Emigrants departing for America, the "land of freedom," leaving old home and friends

INDIANS OF NORTH AMERICA

orable voyage in 1492, when he discovered America, many people have left the Old World in search of wealth and homes in this New World. The eastern coast of the American continents is irregular, and furnishes excellent harbors. Here the white men who came across the Atlantic began to make homes in the best places they could find near the coast. They found upon the American continents a race of people whom Columbus called Indians, because he thought he had reached India. The white men learned from the Indians that the land was rich in gold and silver. They explored the continents by sailing up the broad rivers and hunting for game in the vast forests. They saw that the land was productive. Many people from the crowded countries of the Old World found homes on the Ameri-

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NEW YORK HARBOR

The gate of the "New World," through which immigrants have to pass

can continents. Many found here a refuge from persecution, and a place where they might worship God as they pleased.

The Spanish, the English, and the French made the largest settlements upon the American continents, but at present there is scarcely a nation in the world but has its representatives in the New World.

**Map Questions**

1. What and where are the following? Panama, Greenland, Caribbean, Newfoundland, Vancouver, Haiti, Hudson, Cuba, Horn.
2. Name and describe the largest river system of each continent of this hemisphere.
3. In which continent are found large fresh water lakes? Name these lakes.

**Note Book Requirements**

1. On map No. 2, page 32, locate upon the Western Hemisphere all the divisions of land mentioned in the lesson.
2. Locate zones, and color as upon Eastern Hemisphere.

---

## Lesson XXV

*Map Study — North America*

*Position.*— What ocean is north of North America? What ocean east? What ocean west? What strait separates North America from Asia? What isthmus connects it with South America? In what zones does North America lie?

*Coast Line.*— Which coast seems to be the longest? Which the most regular? Which the most irregular? Which coast is not navigable? Why? Which coast is provided with the greatest number of harbors? What large bay is there in the northern part of North America? What gulf and sea south of North America? Name three peninsulas on the east coast of North America. What large gulf on the southwest coast of North America? What peninsula between this gulf and the Pacific Ocean? What great peninsula in the northwestern part of the continent? Locate three capes on the eastern coast, two on the western, and two on the northern coast of North America.

*Islands.*— On which coast are the largest islands? Where is Greenland? What bay is there west of Greenland? What strait connects this bay with the Atlantic Ocean? Where is Newfoundland? What cape is at the southern point of this island? What island chain southeast of North America? What is the largest island in this group? Name the largest island on the west coast.

*Surface.*— In what part of North America is the great highland region? In what direction does it extend? Measure its greatest width, using the scale of miles. What long mountain chain extends through the central part of this region? What three mountain ranges border the great highland region on the west? Name the principal highland region in eastern North America. Which part of North America is a great lowland plain? Compare the Atlantic Coast Plain and the Pacific Coast Plain in width.

*Drainage.*— What river of the Central Lowland flows

northwest to the Arctic Ocean? What three large lakes are in its basin? What river flows northeast into Hudson Bay? What lake in its basin? What river flows into this lake? What large river flows northeast into the Gulf of St. Lawrence? Name the five "Great Lakes" in its basin. What river rises near the center of the Great Central Plain, and flows south into the Gulf of Mexico? Name two large rivers that rise in the Rocky Mountains and empty into the Mississippi River. Name a river that rises in the Appalachian Highland and empties into the Mississippi. Name a river that rises in the Rocky Mountains and flows southeast into the Gulf of Mexico. Name a river that rises in the Rocky Mountain Highland and empties into the Pacific Ocean. Name a river that empties into Bering Sea.

**Note Book Requirements**

1. Indicate north, south, east, and west on map No. 3, page 33.
2. Locate the Arctic Circle and the Tropic of Capricorn.
3. Trace the coast line of North America.
4. Name the oceans and important bays and gulfs.

---

## Lesson XXVI

*Position and Surface of North America*

In order to study a continent carefully, we need a map large enough to show more things than can be shown on a globe. A map of any part of the world is really, of course, a part of the globe; but the globe has a curved



surface, and a map is flat. There are, however, very good ways of showing a globe surface as a map. In studying maps, we should remember that they represent parts of the curved earth.

ON THE TRAIL NORTH OF PRINCE ALBERT LAND

The black lines extending up and down the page, or nearly so, all run north and south. The same kind of lines extending across the page run east and west. Thus on maps of so large an area as that of North America, the top of the map is not exactly north, and the sides are not exactly east and west. The dark lines, however, tell the direction, and by this means we are able to study the direction of maps.

MOUNT OF THE HOLY CROSS — A PEAK OF THE ROCKY MOUNTAINS

North America is the third largest of the continents, being about one half the size of Asia, and two thirds as large as Africa.

In shape it is triangular, and its coast line is irregu-

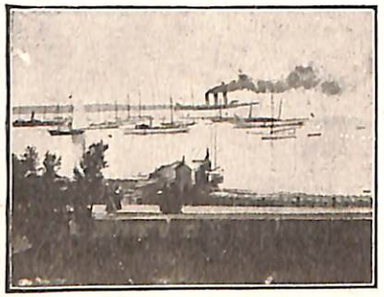
lar. It is washed by the Pacific Ocean on the west and south, and by the Atlantic Ocean and its arms on the east. The Arctic Ocean bounds the frozen shores on the north.

ON HURON'S SHORE

Extending from the North Frigid Zone across the North Temperate Zone and into the Torrid Zone, its climate is varied.

A study of a physical map of North America will show two great highlands. The larger, higher, and broader highland is along the Pacific coast, and is known as the Western Highland. It is made up of many mountain ranges, the most important being the Rocky Mountains, the Sierra Nevada Mountains, and the Cascades. The Eastern Highland extends along the Atlantic coast, and it also is made up of several mountain ranges. What are the principal mountains of this highland?

Between these two great highlands is a great plain, often called the Great Central Plain. Along the Atlantic coast is a narrow, fertile plain, densely peopled.



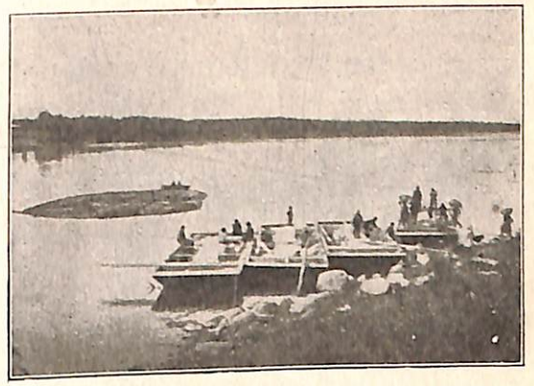
IN THE HARBOR — STRAIT OF MACKINAC

North America has the largest fresh water lakes in the world. It is said that the five Great Lakes of North America contain at least half of the fresh water on the globe. These lakes are Lake Superior, Lake Huron, Lake



Michigan, Lake Erie, and Lake Ontario. There are other large fresh water lakes in North America, but these five are known as the "Great Lakes." Locate Great Salt Lake. This lake is a great inland body of water, and has no outlet. It is intensely salt, and there is much dry salt along its shores.

The largest river in North America is the Mississippi. It has been called the "Father of Waters." The St. Lawrence drains the Great Lakes, and carries large quantities of fresh water into the Atlantic Ocean. "Missouri" means *mud;* and true to its name, the Missouri River carries in its waters much soil. This soil, washed from the Western Highland, makes good farming land in the Mississippi Valley. The Colorado is noted for the wonderful gorges worn by its channel. Perpendicular walls from 2,500 to 4,000 feet in height rise above its bed. Other important rivers are the Columbia, Arkansas, Ohio, Yukon, and Mackenzie.



THE SASKATCHEWAN

A slight elevation of land just north of the Great Lakes, running east and west, divides the waters flowing into the Arctic Ocean from those flowing to the Mississippi or the Great Lakes.

The rivers north of this elevation of land flow from a warmer region into a colder region. Hence their head waters thaw out in spring before the lower portions. As a result, these cold regions have great floods in the early summer.

In the Temperate Belt the large rivers are very important routes to the interior of the continent. Before the white people came, the Indians used the rivers for travel.

In order to make the water routes of greater service, canals have been made in many places. These canals connect large rivers or lakes, and are very important, because they make it possible to transport goods far into the continent without carrying them across the land at all.

**Spell and define**

| | | |
|---|---|---|
| com′ merce | el e va′ tion | high′ land |
| ex plor′ ers | plain | ca nals′ |
| in te′ ri or | drains | gorg′ es |
| tri an′ gu lar | globe | fer′ tile |

**Note Book Requirements**

1. On map No. 3, page 33, outline upon the continent of North America the Great Lakes.
2. Locate Great Salt Lake, Lake Athabasca, Lake Winnipeg, Great Bear Lake, Great Slave Lake.
3. Locate all the important rivers mentioned in the lesson.
4. Locate the principal mountain ranges and the important peaks of the Western Highland region.
5. Locate the principal ranges of the Eastern Highland.
6. Show with yellow crayon the highland regions, and with green crayon the great valley regions.



# Lesson XXVII

*People, Climate, and Countries of North America*

The earth hath He given to the children of men. Ps. 115:16.

The northern portion of North America lies in the Frigid Zone, and is occupied chiefly by wandering Indians and Eskimos. These people live by hunting and fishing; for there is very little else to do in that extremely cold region.

CANADIAN SCENERY IN WINTER

Because Englishmen discovered Newfoundland and the lands near it, the English people claimed nearly the whole of North America; and the northern part, to this day, belongs to England. This part is called the Dominion of Canada.

The southern part of the Dominion of Canada is in the Temperate Belt. Here, where it is favorable for all the important occupations, people may live without suffering from either heat or cold. In a temperate climate people can work outdoors the year around, and hence can accomplish more than people who can work only at certain seasons. Forest-covered highlands and broad, fertile plains invite industry.

South of the Dominion of Canada, stretching across the middle of the continent, is the United States. This country lies in the North Temperate Belt. Here the area

for agriculture is so large that much more food is produced than is needed at home. The ruler of the United States is chosen by the people, and the government is called a republic. As Canada belongs to England, and as most of the white people who live in the United States are of English descent, the English language is spoken by most of the people in these countries.

FOREST WEALTH OF NORTH AMERICAN CONTINENT

South of the United States are Mexico and the countries of Central America. Lying for the most part south of the Tropic of Cancer, they have an altogether different climate. Tropical fruits abound, and vegetation is profuse. Mexico is about one fourth as large as the United States, and has one sixth as many people. The people of Mexico are known as Mexicans. This part of North America was settled by white men from Spain. They spoke the Spanish language; and the Mexicans still speak Spanish, being descendants of those early Spanish settlers and of the



Indians who were already in that part of North America. The Rio Grande may be said to separate the English-

A GREAT WHEAT FARM IN THE NORTHERN PART OF THE UNITED STATES

speaking people from the Spanish-speaking people of North America.

All together there are probably more than one hundred million people living upon the continent of North America. Since agriculture is by far the most important occupation of the people of this continent, we can understand why the majority of the inhabitants of North America are country people. In the time of George Washington, there were very few people living in cities. Even at the present time two thirds of all the people in the United States live either in the country or in towns with a population of less than eight

TROPICAL FOLIAGE IN MEXICO

IN NEW YORK CITY — FLATIRON BUILDING

thousand; and in Mexico and Canada the proportion of people living in the country is larger. However, in sections where manufacturing and trading are the chief occupation, vast collections of people are found living in a small area. How different these large cities are from the country, where only a few houses are to be seen at a time, and where plenty of fresh air and sunlight enter the houses, and large trees and lawns surround the homes of the people.

Of the twenty-five largest cities in the world, but four are situated upon the continent of North America. These are, in order of size, (1) New York, the eastern gateway to the continent; (2) Chicago, the nearest lake port to the great grain region of the continent;

IN A MEXICAN VILLAGE — MT. POPOCATEPETL IN THE DISTANCE



(3) Philadelphia, a great shipping point near the coal fields of the Eastern Highland region; and (4) St. Louis, an important river city in the center of the great Mississippi Valley. Montreal, the principal city of Canada, is situated upon the St. Lawrence River, fully one thousand miles from the ocean. It is a great manufacturing and trading center for that region. Toronto, the second city of Canada, is built upon the shores of Lake Ontario. The City of Mexico, the capital of the Republic of Mexico, is the largest city of that country; and Guatemala is the largest city in Central America.

### Questions

1. In what zone does the northern part of North America lie? the central? the southern?
2. What do you know of the climate of the continent?
3. How does the climate affect the occupation of the people?
4. What country lies in the greatest food producing belt of the continent?
5. What countries are south of this? What country north?
6. About how many people live upon this continent?
7. From what European nation are the North Americans chiefly descended?
8. What language is most used in Mexico?
9. What proportion of the people of this continent live in the country? Why?
10. What two occupations build up the cities?
11. Name and locate the four largest cities of North America.
12. Locate the principal city of each of the countries of North America.

### Requirement

Model in clay or sand the continent you have been studying, locating the highlands, lowlands, and principal rivers.

**Note Book Requirement**

On page 34 of Note Book, write a brief composition upon North America, stating (a) its position, (b) its size, (c) its surface, (d) its lakes, (e) its rivers, (f) its climate, (g) its people, (h) its countries.

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# Lesson XXVIII

## *Map Study — South America*

*Position.*— What ocean lies east of South America? West? What sea north? In what two zones does that continent lie? Use the scale of miles to tell its greatest length and width.

MT. CHIMBORAZO; 21,420 FEET ABOVE SEA LEVEL

*Coast Line.*— Compare the coast of South America with that of North America. Locate the following capes: Cape Frio, Cape St. Roque, Cape Horn, Cape Pariña.

*Islands.*— Compare in number and size the continental islands of North and of South America. What island at the southern extremity of South America? What strait between this island and the mainland? What island situated near the mouth of the Orinoco River? Where are the Falkland Islands? What island at the mouth of the Amazon River?

*Surface.*— What mountains along the western part of the continent? Compare the western highlands of North

America with those of South America, in height; in extent; in number of ranges. What plateau lies in the eastern part of South America? What smaller one in the northeastern part? Find Mount Aconcagua; Mount Chimborazo.

ON LAKE TITICACA

The highest navigated lake in the world, 12,000 feet above sea level

*Drainage.*— Trace the great divide of the continent of South America. Trace the divides of five river basins which together embrace nearly all of the Atlantic Slope. Between what two plateaus does the Amazon lie? Name the principal tributary of the Amazon, flowing into the river from the south. Why are there no long rivers on the Pacific Slope of South America? Compare the lakes of South America with those of North America in number and size. Locate Lake Titicaca.

**Note Book Requirements**

1. Trace the outline of South America on map No. 4, page 35.
2. Locate the Equator and the Tropic of Capricorn.
3. Name the oceans, prominent capes, and islands.

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## Lesson XXIX

### *Physical Features of South America*

South America is broad at the north and narrow at the south, just as we found North America to be; but the

map of the heat belts shows that the northern or broad part of South America lies in the Torrid Zone, while the southern or narrow part reaches through the South Temperate Zone, giving to South America a climate very unlike that of North America.

A SECTION OF RIO DE JANEIRO'S BEAUTIFUL HARBOR

South America has a very regular coast line, most of the shore being very steep and straight. Thus it has few good harbors. However, as in North America, the best harbors are on the Atlantic coast.

Like North America, South America has a high Western Highland and a low Eastern Highland. The western mountains, called the Andes Mountains, contain very many high peaks. Many of these peaks are volcanoes. Aconcagua, the highest mountain peak on that continent, is in the Andes range. This mountain is an extinct volcano, and it is the highest peak in the Western Hemisphere. Mt. Chimborazo is another high peak in the Andes Mountains. Although the heat is so extreme in the lowlands at their base, the summits of these mountains are always covered with snow.

AMONG THE ANDES MOUNTAINS

The Eastern Highland is a broad, low plateau, divided by the valley of the Amazon River into two parts,



known as the Brazilian Highlands and the Guiana Highlands.

The Central Lowlands between these two highlands are drained by three large rivers and their tributaries — the Orinoco, the Amazon, and the Plata. These rivers are navigable throughout the greater part of their course, and are the main routes of travel and trade. Although the Amazon is not the longest river in the world, it is one of the greatest. It drains more land than any other river, and as it runs through a very rainy region, it carries great quantities of water to the ocean. The eastern slopes of the Andes, three thousand miles from the Atlantic coast, can be reached by boats up the Amazon.

**Note Book Requirements**

1. On map No. 4, page 35, outline and name the principal rivers of the continent.
2. Name and locate the mountains of the Eastern Highland.
3. Locate the highest peak on this continent.
4. Locate the Brazilian and Guiana Highlands.
5. Show with colored crayon the highlands and lowlands of the continent.

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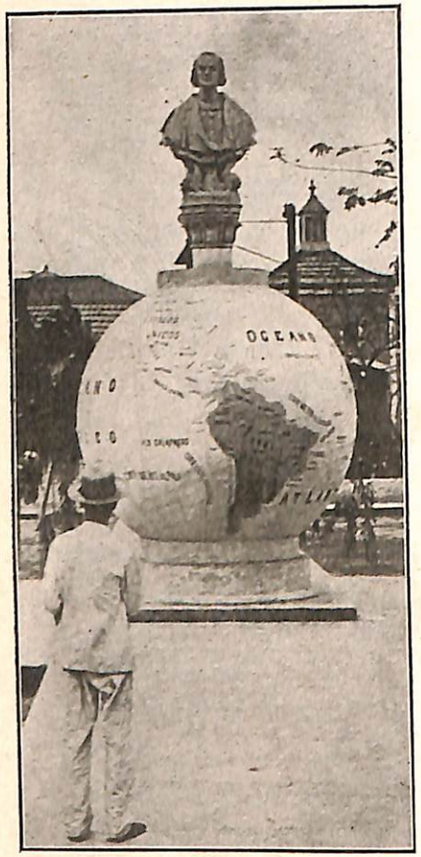
## Lesson XXX

*Education and Religions of Western Hemisphere*

Columbus discovered the Americas at the Bahama Islands in 1492. On his third voyage to the New World, he discovered the continent of South America, landing at the mouth of the Orinoco. This was in 1498.

Spain and other Catholic countries continued to explore the newly found continents; and many people from those countries settled in South America, Central America, Mexico, the West Indies, and the southern part of what is now the United States.



STATUE OF CHRISTOPHER COLUMBUS

Showing an outline of the hemisphere discovered by that great navigator. The statue occupies the center of one of the principal squares of the city of Maracaibo, Venezuela, South America.

To the tribes of heathen people already inhabiting the countries, they taught the religion of the Catholic Church. They taught also their respective languages, setting up governments and schools for the people wherever they settled.

In North America, the English and other Protestant nations made settlements, and taught the Protestant faith. In time the English language, the English standard of government and education, and the Protestant religion, became more prominent in North America than elsewhere in the Western Hemisphere.

North America, in general, became an asylum to the oppressed and persecuted Protestant churches. The government of the United States was founded on principles



of liberty in religious things; and it was left to every man, woman, and child to choose how and when he should

NEW YORK HARBOR — STATUE OF LIBERTY IN THE DISTANCE

worship God, and to what church he should belong. With such freedom of conscience and liberty to study and to think, great progress in education and civilization has been possible in North America.

In South America, where church and state were united, and where the people were harshly ruled, and much at war, great advancement has not been possible. Because of these things, progress in all these countries has been slow.

Then, too, South America, as a whole, is more sparsely settled than North America. The interior is very thinly peopled; and it is only along the coast, especially the western coast, that marked advancement has been made.

A POPULAR PARK IN BUENOS AIRES

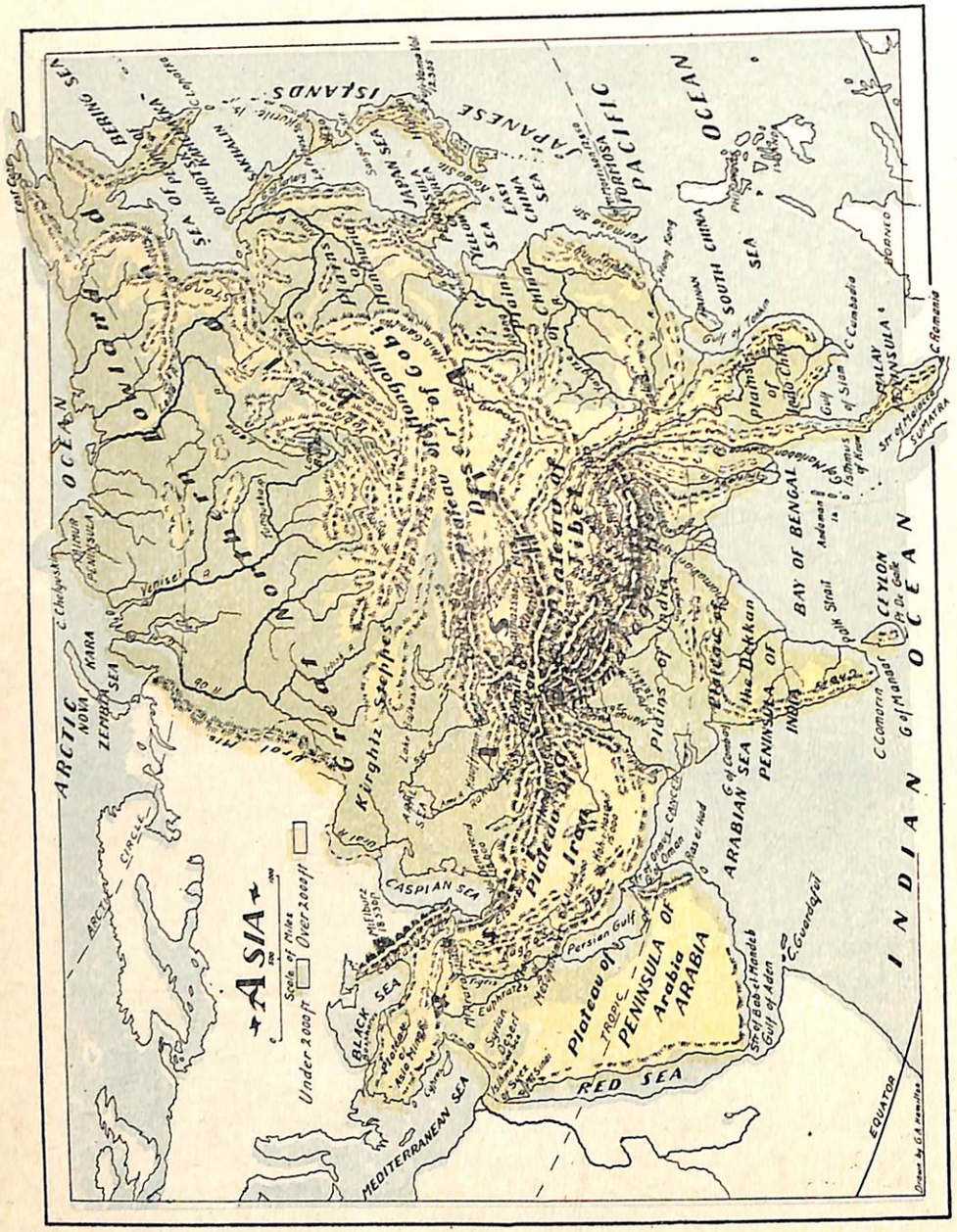
From this park can be seen a long stretch of the Plata River.

But now nearly all the countries of South America are opening wide their doors to improvement. In Buenos Aires, the largest city of South America, and the fourth in size in the Western Hemisphere, there are schools and colleges, electric lights, and street railways. Rio de Janeiro, the second city of the continent, is situated at one of the few fine harbors on the eastern coast, and is the center of a large trade.

But better than all other advancement is the fact that now, in nearly all the South American countries, the laws are being so changed that people of any faith may live, and worship God as they think right. Let us hope that the continent so long known as the "neglected continent," may henceforth have the full light of God's message to man.

**Questions**

1. When and where did Columbus first discover America? (Find out all you can about this man.)
2. Which continent did Columbus really discover? When? At what place?
3. What race of people was found upon these continents? (Find out all you can about these people, and the way they were treated by the Europeans.)
4. In which continent did the English and other Protestant nations make settlements?
5. Where did the Catholic Europeans settle?
6. Contrast the present condition of the people of the two Americas.
7. Name and locate the two largest cities of South America.
8. Name and locate the four largest cities of North America.
9. Locate Maracaibo City.






Requirement

Write a story on one of the following subjects: (1) Columbus, (2) The red men of America, (3) The Pilgrim Fathers, (4) The cities of America, (5) America's greatest need.

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# Lesson XXXI

## *Map Study — Asia*

*Position.*— What oceans wash the shores of Asia? Locate each. What continents lie west of Asia? How are they connected with it? In what zones does the continent of Asia lie?

IN THE PHILIPPINE ISLANDS

*Coast Line.*—How does the coast line of Asia compare with that of other continents studied? Name five great seas along the Pacific coast. What great bay and what sea reach northward from the Indian Ocean into Asia? What strait and what gulf connect the Red Sea and the Arabian Sea? Name two large seas connected with the Atlantic Ocean that form parts of the western boundary of Asia. Locate two peninsulas of eastern Asia, and three of southern Asia. Find Cape Comorin, Cape Romania, Cape Cambodia, and Cape Lopatka.

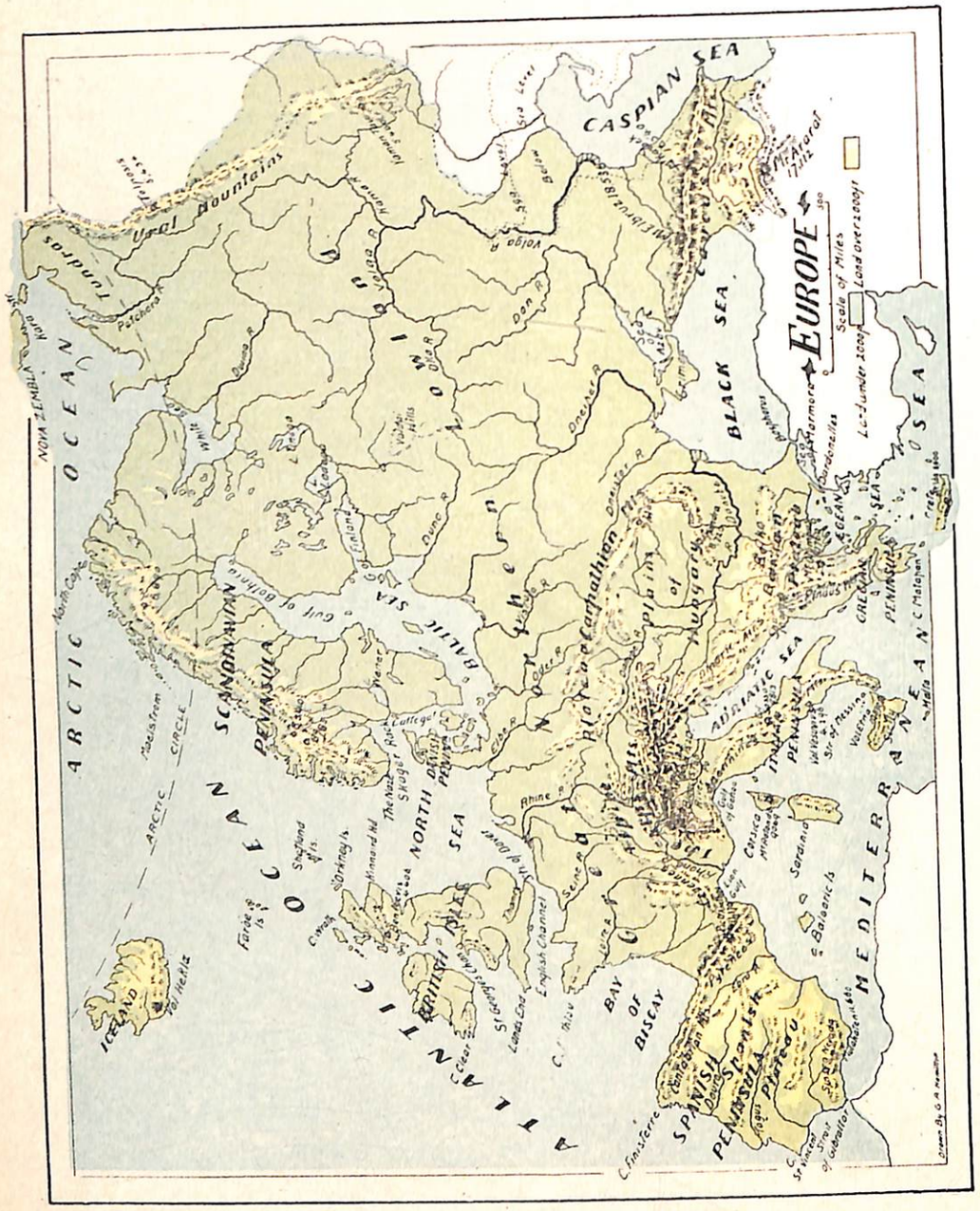
*Islands.*— What important group of islands lies east of the Japan Sea? What island is separated from China by Formosa Strait? Where is Ceylon? Where are the Philippine Islands? Name the four largest islands of the East Indies.

MT. EVEREST

The crown of the world, the highest peak known, 29,002 feet

*Surface.*— In what part of Asia are nearly all the highlands? Find four large plateaus in the highland region of Asia. What part of Asia is a wide lowland plain? Find three lowland plain regions on the Pacific Slope; two on the Indian Ocean Slope. Where are the Himalaya Mountains? What are other principal mountain ranges of Asia? Locate Mount Everest. What do you know of its height?

*Drainage.*— Name three great rivers of Asia that flow north into the Arctic Ocean. Name four that flow into the Pacific Ocean. Name a large river of India that flows into the Bay of Bengal. Name one that flows into the Arabian Sea. Find the Euphrates River. Into what gulf does it flow? Name a large inland sea that forms part of the western boundary of Asia. Name two other large inland seas of Asia. Find Lake Baikal. What two great seas and what river form part of the boundary between Europe and Asia?


CASPIAN SEA
EUROPE
Scale of Miles
Land over 1000 ft
Ural Mountains
Tundras
Volga R.
Don R.
Dnieper R.
BLACK SEA
Sea of Azov
Dardanelles
Sea of Marmora
Aegean Sea
Crete
Rhodes
Caucasus Mts.
Mt. Ararat
ARCTIC OCEAN
NOVA ZEMBLA
North Cape
ARCTIC CIRCLE
Gulf of Bothnia
Gulf of Finland
SCANDINAVIAN PENINSULA
Hammerfest
Trondhjem
Hekla
Vesuvius
Etna
Strait of Messina
Valetta
Malta
Crete
Rhodes
Cyprus
Sardinia
Balearic Is.
Corsica
Gibraltar
Strait of Gibraltar
Cape Matapan
Mt. Olympus
Mt. Pindus
Mt. Rhodope
Mt. Balkan
Mt. Carpathian
Plateau of Hungary
Plateau of Bohemia
Plateau of Switzerland
Alps
Pyrenees
Rhine R.
Seine R.
Loire R.
Thames R.
Elbe R.
Oder R.
Vistula R.
Danube R.
Po R.
Ebro R.
Tagus R.
Guadalquivir R.
Rhone R.
Gulf of Lyons
Gulf of Genoa
Adriatic Sea
Ionian Sea
Aegean Sea
Sea of Marmora
Dardanelles
Caucasus Mts.
Mt. Ararat
Crimea
Sea of Azov
Volga R.
Don R.
Dnieper R.
Ural Mountains
Tundras
Pechora
Petchora
Nova Zembla
North Cape
Arctic Circle
Gulf of Bothnia
Gulf of Finland
Scandinavian Peninsula

*Islands.*— What two large islands lie west of the mainland of Europe? Where is Iceland? Name three large islands in the Mediterranean Sea.

*Surface.*— What mountains shut off the Spanish peninsula from the rest of Europe? What mountains in the Balkan peninsula extend east and west? What range of mountains is there in the Italian peninsula? Locate the Carpathian Mountains. Locate the Ural Mountains. What mountain range is there in the Scandinavian peninsula? Find the Alps Mountains. What mountains lie between the Black Sea and the Caspian Sea? Where are the Valdai Hills?

*Drainage.*— What three great rivers rise in or near the Valdai Hills and flow in different directions, one into the Caspian, one into the Black, and one into the Baltic Sea? Name a river that rises in the Alps and flows into the Black Sea. Name a river that rises in the Carpathian Mountains and flows into the Baltic Sea. Name two rivers that flow northwest into the North Sea. Name two that rise in or near the Alps highlands and flow northwest, one into the Bay of Biscay and the other into the English Channel. Name a river emptying into the Adriatic Sea.

**Note Book Requirements**

1. On map No. 6, page 37, trace the coast line and rivers of Europe.
2. Locate the principal mountain ranges.
3. Show with colored crayon the highland and the lowland regions.
4. Name the large seas and bays that surround this grand division.
5. Name the principal islands.



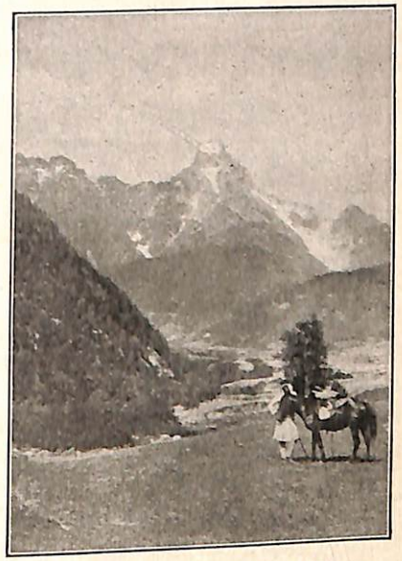
# Lesson XXXIII

## *Physical Features of Eurasia*

East of the Americas, across the great Atlantic Ocean, lie the continents of the Old World.

GLACIER OF THE RHONE RIVER, SWITZERLAND

"Europe" is the name by which the western portion of the Old World is usually known, and "Asia" is the name given to the entire adjoining portion of the great land mass east of Europe. However, because, as you can see by the maps, Europe and Asia are not so clearly and distinctly separated from each other as are all the other continents, they are often called one continent under the name "Eurasia."



THE CAUCASIAN GIANTS

One of the peaks is in Europe and one in Asia.

The coast of Eurasia is very irregular, having many peninsulas and islands, but, like each of the Americas, its general shape is that of a triangle. Stretching, as it does, from the North Frigid Zone into the Torrid Zone, the climate is extremely varied.

The mountains, instead of extending north and south as do the primary ranges of the New World, extend in a general east and west direction. The loftiest mountains of this land mass, in fact the highest in the world, are the Himalayas of south central Asia. The highest peak of this range, Mount Everest, is over twenty-nine thousand feet, or about five and one half miles, above the sea. Mount Elbruz, in the Caucasus Mountains, is the highest peak of Europe; and the Alps, farther west, are famous mountains.

GRAZING ON THE LOWLANDS OF WESTERN EUROPE

North of the Himalayas are lofty plateaus. One of these, the plateau of Tibet, is about three miles in height. This high inland region is always dry, because the winds from the oceans lose their moisture on the high mountains surrounding it. The low plains extending northward from these mountain ranges and plateaus, are frozen desert regions the greater part of the year. A low mountain range extending north and south divides the great northern plain of Eurasia, and this range is sometimes called the boundary between Europe and Asia.

Western Europe is warmed by a broad current of warm water, known as the Gulf Stream, which flows northeast in the Atlantic Ocean from the tropic southern



seas, carrying with it the warm breezes of milder regions. Southern Europe is famed for its delightful and uniform climate; but the southwestern portion of Asia is mainly desert. This is because in the latter region, the winds, blowing from the land instead of from the sea, contain little vapor.

A VIEW OF THE WATER FRONT, ST. PETERSBURG

The drainage of Eurasia is determined by the position of its highland regions. The mountains and plateaus, as you can see from the maps, form a great watershed.

Many of the rivers both of Europe and of Asia make excellent water ways for commerce. Some of the largest rivers in the world flow east or south from the eastern arm of the Eurasian highland. The greatest river in Europe is the Volga. It flows into the Caspian Sea. This sea, like several other large lakes of Asia, has no outlet. The Caspian Sea and the Black Sea are on the boundary between Europe and Asia. Other rivers draining the great plain of Europe, flow southward into these seas, but many flow north and west to the ocean. The largest of those flowing northward are in the Asiatic part of the grand division, and flow into the Arctic Ocean. They are frozen over for most of the year.

**Requirements**

1. Using the scale of miles, find out the greatest distance from east to west and from north to south. Compare this with other continents studied.
2. Make a list of the large peninsulas of Eurasia; make a list of its large seas and bays; of its great plateaus and mountain ranges; its long rivers; the large continental islands.

**Note Book Requirement**

On map No. 5, page 36, show with colors the highland and lowland regions of Eurasia.

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## Lesson XXXIV

*People and Countries of Eurasia*

Eurasia has been the home of civilized man ever since the beginning of history. It is the most densely peopled of the grand divisions, containing three fourths of all the people in the world; and from Eurasia people are constantly emigrating to all

VILLAGE SCENE IN SOUTHERN ASIA



parts of the globe. There is hardly a city of the New World but contains representatives of the European and Asiatic peoples — hundreds and thousands of them; and, of course, we know that from the European division came the people from whom are descended the nations now occupying North and South America, and for the most part Africa and Australia.

ARAB BOYS AT THEIR STUDIES

They use no books, and most of their lessons are oral.

From our study of the surface and drainage of Eurasia, we can easily see why the greater part of the population is found in eastern, southern, and western Eurasia. Here fully two thirds of the people live in regions of very dense population; but in the forests of the islands and the mainland of the extreme southeast, and along the bleak Arctic shores, there live tribes of savage men, who know but little of the ways of civilization. The civilization of Asia is less advanced than that of Europe, and because of the lack of improved implements and means of transportation, the products and commerce of Asia are slight in comparison with its population. The foreign commerce of Asia is but one sixth that

A NATIVE OF SOUTHERN ASIA

of Europe, although there are twice as many people in Asia as in Europe. In the moist regions of the southern part of Asia, where there is a dense population, food is fairly plentiful. But when the crops fail, a terrible famine occurs, and thousands of people starve, because there is no easy way of transporting food to them. The few railroads are mostly in the hands of Europeans.

IN JAPAN

Throughout the most of Asia, the women are considered as little more than servants, or slaves. They are seldom educated, and in some countries are bought and sold. The native peoples on the mainland of Asia have not learned how governments may be conducted for the benefit of the mass of the people. Most of the countries are absolute monarchies, and the ruler often treats his subjects unjustly. The people of the island empire of Japan are the most progressive of the native people of Asia. Their government is a limited monarchy. Not all the countries of Asia are independent; some of them are ruled by European powers.

In Europe the governments are nearly all independent, each having its own language and customs. Most of these governments are limited monarchies. Great Britain, Germany, France, Russia, Austria-Hungary, and Italy are



the strongest nations of Europe, and are often called the "Six Great Powers."

The people of Europe are engaged in agriculture, manufacture, and commerce. The great food belt of Europe extends from the Atlantic through the central lowland, — southern Russia, and the southern valleys of the Po, the Rhone, the Danube, and of the streams of the Spanish peninsula. The forests of northern Russia, the Scandinavian peninsula, and the wooded slopes of the Carpathian Mountains, are the chief lumber regions of Europe.

IN GERMANY

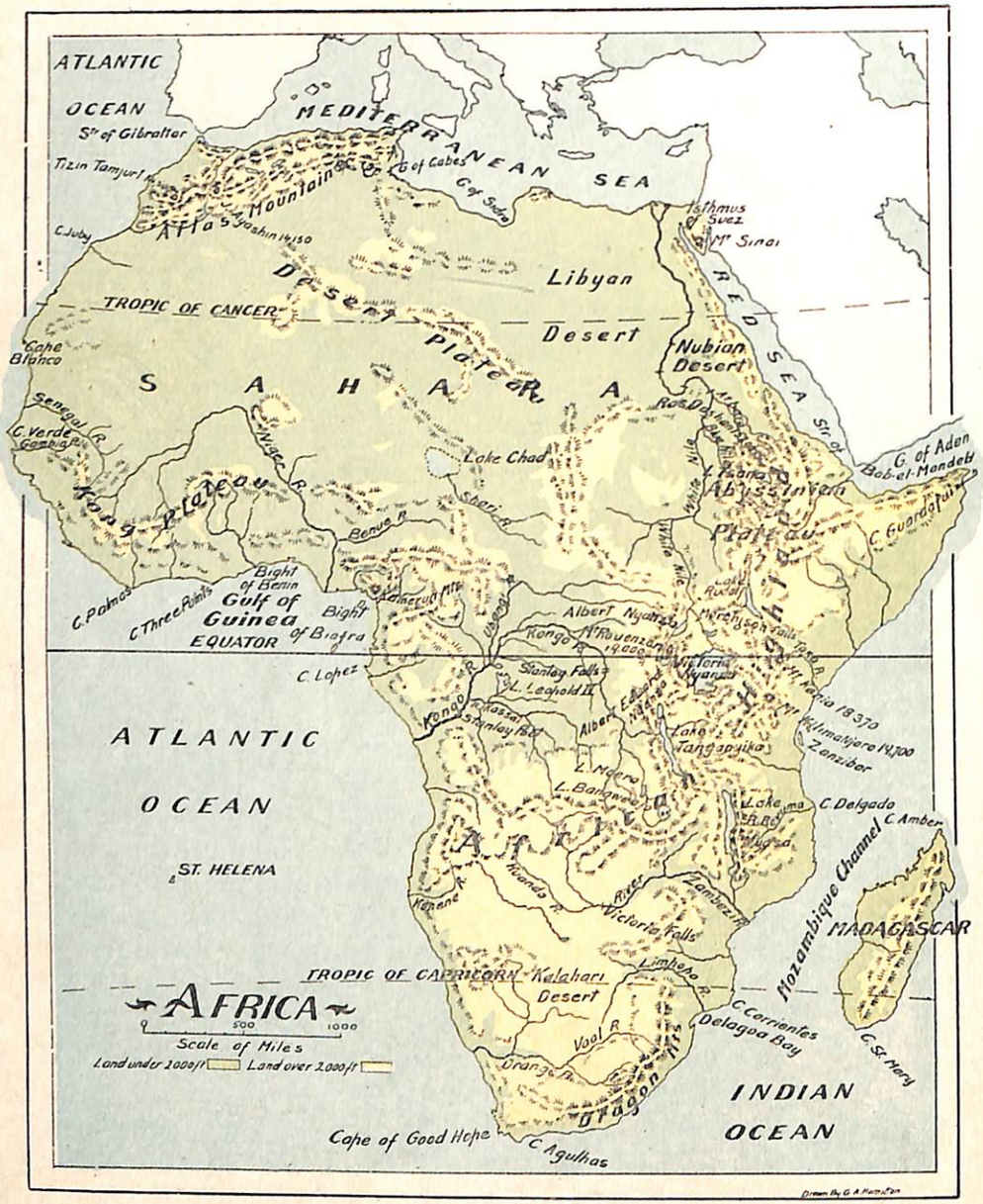
The water routes are much used in Europe, as nearly all the rivers are navigable, and are connected, by canals, with neighboring rivers. The Caspian and the Black Sea have thus been connected with the Baltic Sea. Upon these water routes, and along the coast line wherever there are good harbors, many large cities have been built. Of the twenty-five largest cities of the world, all but five are located in Eurasia. London, the largest city and the greatest shipping point in the world, stands first. Paris,

IN PARIS

the next largest city in Europe, and the third city in the world; Berlin, a great manufacturing city in Germany; Hamburg, the most important seaport on the continent of Europe; Vienna, situated on the Danube River; St. Petersburg and Moscow, in Russia; Constantinople, at the outlet of the Black Sea; Glasgow, in Scotland; and Liverpool, in England, are all cities about which we shall learn more in the future. Five of the world's greatest cities are in the Chinese Empire, of which Pekin is the capital. Tokyo, the capital of Japan, is an immense city; and Bombay, on the western coast of the Indian peninsula, is an important business center for the Indian Ocean.

**Questions**

1. How long have men been living in Eurasia?
2. What good reason have we for believing that the garden of Eden was planted upon this continent? Gen. 2: 8.
3. How closely are all nations related? Acts 17: 26.
4. Why does God appoint "their times" and the "bounds of their habitation"?
5. What portion of the earth's inhabitants live in Eurasia?
6. What part of this number live in regions of dense population?
7. In what sections of the great division do they live? Why?
8. What can you say of the civilization of Asia?
9. What form of government have most of the countries of Asia?
10. Which is the most progressive Asiatic nation?
11. Name the six "Great Powers" of Europe.
12. What are the occupations of the people of Europe?
13. Name and locate ten large cities of Europe and five of Asia.
14. Explain, if you can, why cities have been built up at these points.
15. What do the peoples of Eurasia need more than all things else?






# Lesson XXXV

## *Map Study — Africa*

*Position.*— What two continents are north and east of Africa? What oceans border it? In what zones does it lie? What American city is about as far north of the Equator as the most northern part of Africa? What city is about as far south as the southern point of Africa?

*Coast Line.*— Compare the coast line of Africa with that of the other continents. Which continent does it most closely resemble in regularity of coast line? What great sea lies between Africa and Europe? What strait connects this sea with the Atlantic Ocean? What sea and gulf are between Africa and Asia? What strait connects these two bodies of water? What great gulf is there on the Atlantic coast? Name the capes at the southern, eastern, northern, and western points of the continent.

*Islands.*— What large island is east of Africa? Is it a continental, or an oceanic island? What channel separates this island from the mainland?

*Surface.*— Which part of Africa is mostly highland? Which mostly lowland? Do you see any advantage in the fact that the interior of the continent is mostly highland region? What mountains are there in northern Africa? Describe the principal highland region of Africa. Find Mount Kilima-Njaro and Mount Kenia.

*Drainage.*— Which slope of Africa contains the greatest rivers? Name five large river systems of that continent. In what lake does the Nile rise? What large

lake is tributary to the Zambezi? Give the name of the lake which lies between the central and the western highland region in central Africa. What large lake is tributary to the Kongo River? What canal crosses the Isthmus of Suez?

**Note Book Requirements**

1. On map No. 7, page 38, trace the outline of the continent of Africa.
2. Locate upon this outline the principal rivers of Africa; the chief mountain ranges and mountain peaks of that continent; its largest islands and capes; its largest lakes.

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## Lesson XXXVI

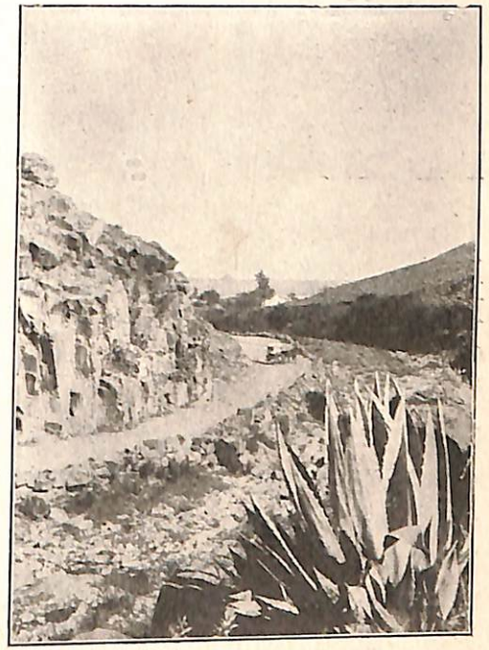
*Surface and Drainage of Africa*

Africa is the largest continent, except Asia. The coast line of Africa is remarkably regular, resembling in this respect South America and Australia. Like the former, its shape is triangular; and its position in the heat belts is also similar to that of South America.

Africa has few mountain ranges such as we have found in all the other continents; but the central part of the entire continent is mainly a plateau, and above this plateau region there rise a few high mountains. In northern Africa the Atlas ranges reach to a height of fourteen thousand feet; but the loftiest mountains are in the southeastern part of the continent. Kilima-Njaro and Kenia are Africa's highest peaks.



The larger part of the coast of Africa is bordered by a low, narrow plain. This strip of coast land is well watered by the winds that blow from the sea; and between the tropics, the coast is everywhere hot and moist. On the northern coast region and mountain slopes of Africa, and on the southeastern slopes, where the winds bring a moderate rainfall, the climate is such that these sections are the best developed of the continent. You will observe that the extreme northern and southern parts of Africa are in the temperate heat belts.



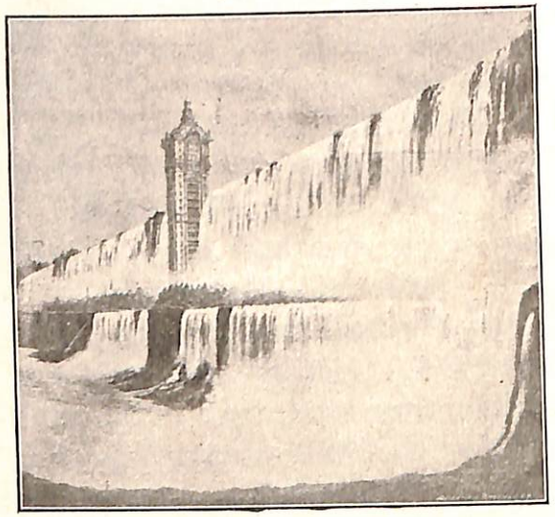
AN AFRICAN PASS

The Equator crosses Africa nearly in the middle of the continent; and for some distance north and south of this line, heavy rainfall and extreme heat prevail. At the Equator, the land is densely covered with tropical forests, and in places the vegetation is so rank that a dense jungle is formed. Besides these wonderful tropical forests, there are, in middle Africa, vast treeless plains, and immense marshes, and some of the largest rivers and fresh water lakes in the world.

But between the fertile lands of northern Africa and

AVENUE OF OAKS, SOUTH AFRICA

the tropical vegetation of the equatorial region there lies a vast rainless tract. The great Sahara Desert, one thousand miles in width, covers an area as large as that of the entire United States. Can you picture to yourself such a great stretch of shifting sand, broken only by occasional hills and mountains of naked rock? Can you think what it would be like to find yourself traveling under the intense rays of the tropical sun, with not a cloud in the heavens to relieve the scorching heat? The only means of crossing the desert is by caravan, and it is stated that the trip from north to south requires fully three months. It is needless to say that such a trip is a great undertaking. However, here and there in the great expanse of sand fertile spots, like green islands, spread their rich, cool carpet of fresh grass. Here the waving plumes of the feathery date palm invite the travelers to



SINGER BUILDING, NEW YORK, COMPARED WITH NIAGARA AND VICTORIA FALLS

Niagara Falls, 168 feet high; Victoria Falls, 400 feet high; the Singer Building rises above the crest.



halt; and the spring or well, bubbling up from the earth, slakes the thirst of the weary caravan. It is said that there are some four hundred of these *oases* in the great African desert.

WATERING PLACE IN A DRY REGION OF AFRICA

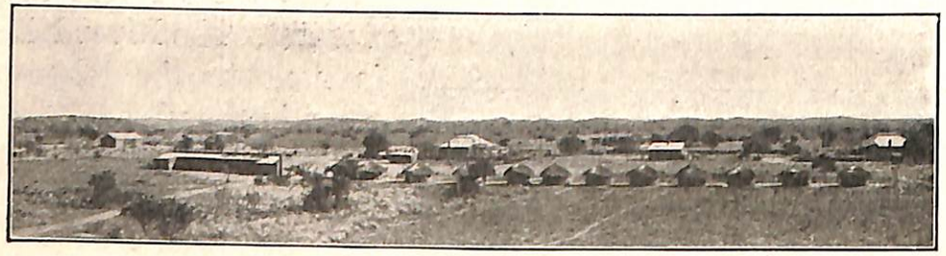
Because of the position of the highlands, which form a divide for the principal rivers, there are several very long rivers in Africa; and because of the heavy rainfall near the Equator, these rivers are supplied with an immense volume of water. The River Nile is next to the longest river in the world. For a long time its source was not known. Livingstone discovered that it has its rise in the great lake called Victoria Nyanza; and so its length is more than half the length of the entire continent. The Kongo River also is very large. It drains a greater region than any other river in the world except the Amazon, in South America. The

ON THE ZAMBEZI BELOW VICTORIA FALLS

Niger and the Zambezi are other important rivers of Africa. The falls, or rapids, that occur in nearly all the rivers of Africa, interrupt navigation. However, railroads around some of these falls, have been planned, and these will make commerce with the interior possible. A railroad is in process of building, that will connect Cape Town in southern Africa with Cairo in Egypt. (Cairo is the capital of Egypt, and the largest city on the continent.)

THE NILE AT CAIRO

Although Africa has for so long been regarded as the "Unknown Continent," and the "Dark Continent," yet we

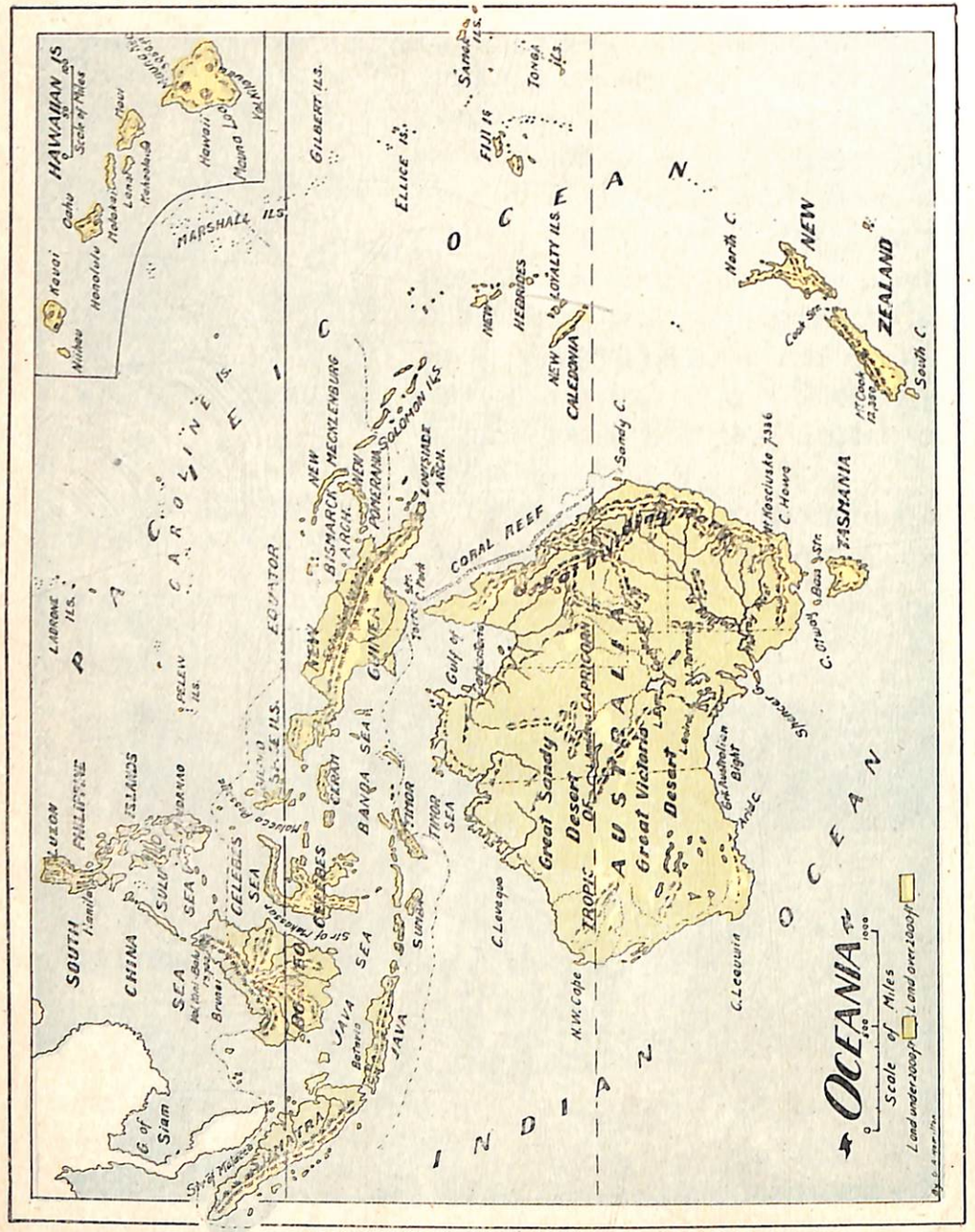


A MISSION IN AFRICA

are glad that into the darkness of that land the light of the gospel has already begun to shine forth.

**Spell and define**

pla teau′
com′ merce
rap′ ids
is′ land
in te′ ri or
riv′ er
des′ ert
ex plore′
peak
plain
o′ a sis
nav i ga′ tion






### Questions

1. Compare Africa in size with the other continents; in shape; in outline; in position.
2. What can you say of the mountains of Africa?
3. Where do we find the best developed sections of the continent?
4. Where do heavy rainfall and tropical heat prevail?
5. Locate and describe the Sahara.
6. Describe an oasis.
7. What do you know of the rivers of Africa?
8. What interrupts navigation in Africa?
9. Tell what you can of the lakes of Africa.
10. What and where is Cairo?

### Note Book Requirement

On map No. 7, page 38, indicate with colors the highland and the lowland regions of Africa.

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## Lesson XXXVII

*Map Study — Australia*

*Position.*— What ocean is west and south of Australia? What ocean east and north? What tropic crosses Australia? Which direction is the Equator from that continent? Is there any other continent lying wholly in the Southern Hemisphere? How would you reach Australia from your home?

*Coast Line.*— Compare the coast line of Australia with that of the other continents. What obstacle to navigation extends along the northeast coast? What gulf is on the northern coast? Find the Great Australian Bight. Where

is Spencer Gulf? Find North West Cape, Cape Leeuwin, Cape Otway, Cape Howe, and Cape York. Are there any large peninsulas on this continent?

*Islands.*— What island south of Australia? Where are the islands of New Zealand? Locate other island groups. What large island belonging to the East Indies is separated from Australia by Torres Strait? In what direction are the Philippine Islands from Australia? Estimate the distance. Where are the Hawaiian Islands? What do you know of the size and number of the smaller islands of the Pacific Ocean? What is the shape of the small coral islands, or reefs, called atolls?

MARINE FISHING VILLAGE, NEW GUINEA

The houses are built upon piles in shallow water.

*Surface.*— To what continent already studied are the highlands and lowlands of Australia similar? In what part of Australia is the greatest extent of highland found?

*Drainage.*— What is the largest river system in Australia? Where on that continent are there other streams? Where are there lakes?

**Note Book Requirements**

1. On map No. 8, page 39, name the waters that wash the shores of this continent.
2. Name the large islands and groups of islands shown upon the map.
3. Locate the Murray river system.
4. Show with colors the highlands and lowlands.



# Lesson XXXVIII

## *Australia*

"Australia" is a word meaning *Southern Land.* This is an appropriate name, because Australia lies apart from the rest of the world, in the great Southern Hemisphere, where there is very little land. It is an island continent, the smallest of all the continents, being not quite as large as the United States.

Bordering the eastern, the southwestern, and the northern coasts, is a circular range of low plateaus and mountains. These mountain ranges are little more than hills in some places, and yet they are so high as to allow but little moisture to reach the interior of the continent, which is, as a result, a wide desert plain. The winds are mostly from the southeast, and thus the eastern mountains receive an abundance of rain on their coast, or windward sides, but the middle plain is almost rainless.

SHEEP GRAZING

The raising of sheep and cattle is one of the principal industries of Australia.

As a result of the dryness, there are few rivers in Australia, and in seasons of drought the largest rivers become too shallow for navigation, and some of them are little more than chains of shallow pools. The Murray River and its branches form the largest river system in Australia, and yet even the main stream of this system is not deep enough to float large sea-going vessels. After

heavy rainfalls in the mountains, small vessels can ascend the Murray and some of its branches. The rivers that rise in the border ranges and flow inland, are lost in the shallow salt lakes or the sandy marshes of the interior.

Australia is not so densely peopled as the other continents. Having so much desert region, and having no navigable rivers, a large part of the continent has never been thoroughly explored. The Europeans who have settled in Australia have made their homes chiefly in the southern and eastern portions of the continent. Here they are engaged principally in mining and stock raising. More than half the people live in cities, and manufacturing has grown to be a chief industry.

RIVER SCENE IN FIJI

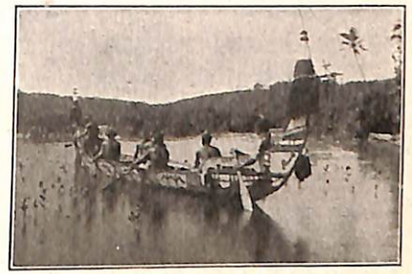
Melbourne is the largest Australian city. It is beautifully situated at the head of a broad harbor. Sydney is the oldest city in Australia, and is also noted for its fine harbor.

Tasmania belongs to Australia, and has been called the Switzerland of the South, because of its delightful mountain scenery. About a thousand miles farther east are the two large mountainous islands of New Zealand. North of Australia there are many islands. Some of them are among the largest in the world, and others are but small rocky points lifted above the ocean's surface.



There are many groups of small islands rising out of the Pacific Ocean. Some of these islands are too small to be shown on the map. Some are ringlike coral islands, called atolls.

In these places, made beautiful by the Creator's handiwork, there existed, before the coming of the white man, the very lowest types of savage life. The Europeans found upon the island continent, and upon many of the smaller islands of the southern Pacific, different tribes of savage, black-skinned men, who, like the Negroes of Africa, wandered from place to place, making war with each other, and gaining their living by hunting. Among these people there were cannibal tribes, men who feasted upon human flesh.



SOUTH SEA ISLAND CANNIBALS

Most of the natives of the East Indies are of Asiatic descent; but those of New Guinea, like those of Australia and other near-by islands, are a black-skinned people, very unlike the Asiatics. There are thousands of these natives yet alive, but the gospel carried by the faithful missionaries has done much to teach them better ways of living. Here that noble man, John Williams, laid down his life, and here Paton and others labored. Still there are many of these islanders yet unreached; for it is said that about one third of those who remain, wander, as did their ancestors, in the wild interior. Truly the isles "wait for His law."

### Questions

1. Describe Australia as to size, shape, position, and outline.
2. Describe its surface.
3. What can you say of the climate?
4. When does summer come to that continent?
5. What do you know of Australian lakes and rivers?
6. What are the principal occupations of the people of Australia?
7. Tell what you can of the natives of Australia and the Pacific islands.
8. How do the natives of the East Indies differ from those of Australia?

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## Lesson XXXIX

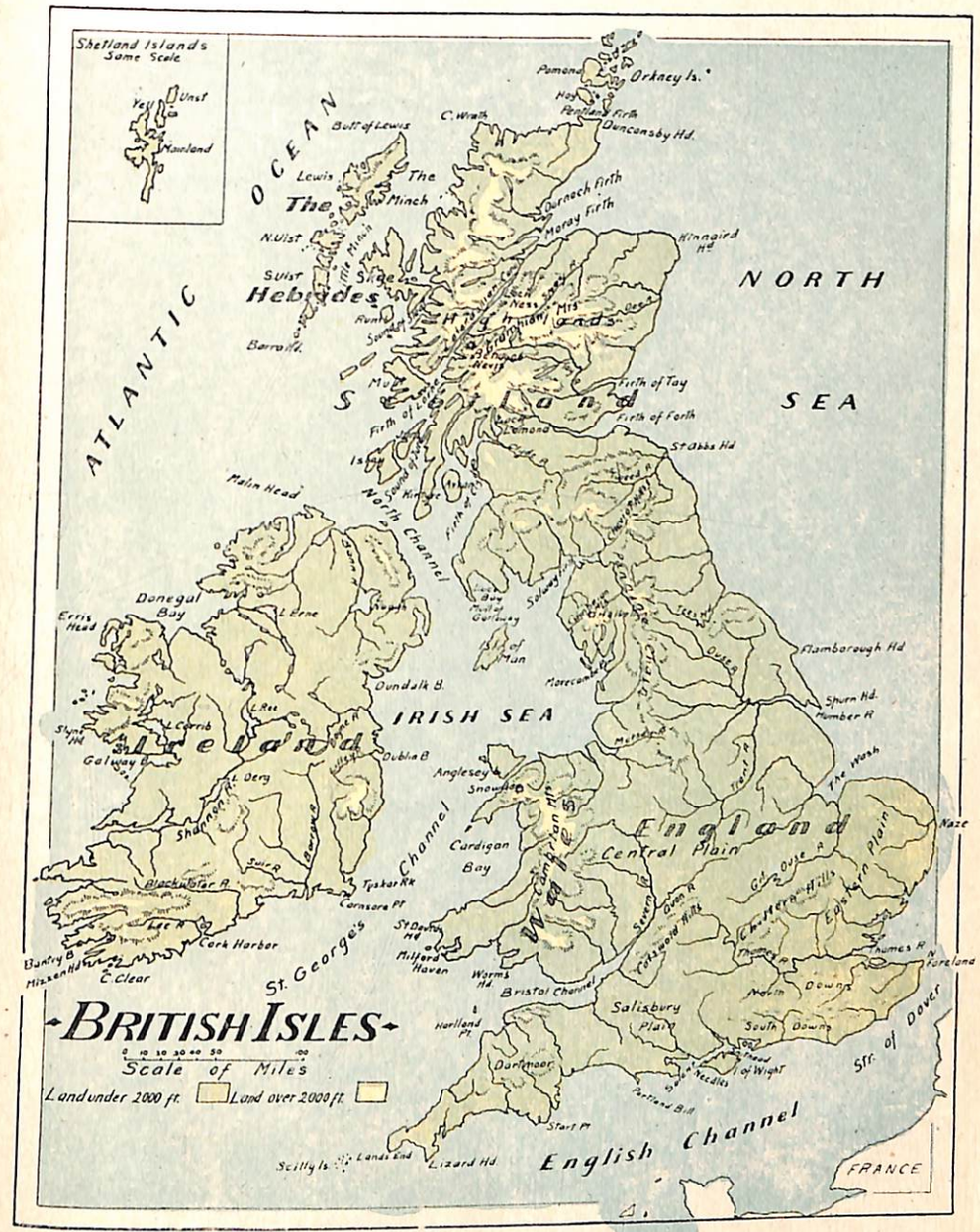
### *Map Study — The British Isles*

*Position.*— By what waters are the British Isles surrounded? In what zone are these islands situated? What is their position with reference to the Arctic Circle?

CLIFFS AT LANDS END

*Extent.*— Name the two largest of these islands. Using the scale of miles, tell the greatest distance between these two islands, and the greatest length and width of each.

*Coast Line.*— Describe the coast line. Locate the Wash, the Firth of Forth, Moray Firth, Firth of Lorne, Firth of Clyde, and Bristol Channel. Find also Lands End, Duncansby Head, Cape



Wrath, Malin Head, and Mizzen Head. Where is the English Channel? the Irish Sea? the North Sea? What strait connects the English Channel and the North Sea? What channel connects the Irish Sea and the Atlantic Ocean on the south? on the north?

*Islands.*— Name three groups of islands north of Great Britain. Name a group south. What island in the Irish Sea? Where is the Isle of Wight?

*Surface.*— Describe the surface of England; of Ireland. Find Ben Nevis. Where are the Cheviot Hills? Grampian Mountains? Cambrian Mountains? Find the River Thames, the River Clyde, and the Severn River.

*Cities.*— Locate London, Liverpool, Glasgow, Manchester, Dublin, and Queenstown.

**Note Book Requirements**

1. Outline the two largest islands of this group on map No. 9, page 40 of Note Book.
2. Trace the rivers and locate the mountains mentioned in the lesson.
3. Name all the salt water bodies you have located.

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## Lesson XL

*The British Isles*

Directly west of the European mainland, and at the very front entrance of that continent, lies a group of very important islands. The British Isles have been called the great work shop of the world, and here we find the world's commercial and financial center.

The islands of Great Britain and Ireland are separated from each other by the narrow Irish Sea, which at one point is only thirteen miles in width. These two islands and the surrounding smaller islands comprise the United Kingdom of Great Britain and Ireland.

In area the United Kingdom does not equal the single State of California in the United States, and is only one thirtieth as large as the Dominion of Canada — an important possession of the British government in North America. In fact, it is said that there is not a spot of soil in the British Isles that is more than seventy miles from salt water; and yet the population of the group is one half that of the United States of America, which has an area forty times as great!

THE CLIFFS OF DOVER

London, that immense city, the largest in the world, having a population of six and one half million, is situated upon the island of Great Britain, and is the capital of not only the United Kingdom of Great Britain and Ireland, but the entire British Empire.

British colonies, planted and ruled by this government, are found in every one of the grand divisions of the earth and in many islands of the sea; so that the British Empire, including the British Isles and all the countries belonging to the British government, numbers one fourth of the world's inhabitants as its subjects, and controls one



fifth of the land surface of the globe. Among the important possessions of this government are India, southern Africa, Canada, and the continent of Australia.

The early inhabitants of the British Isles were a hardy and energetic people. In addition to farming and herding, the resources of their country invited them to engage in mining and manufacturing; and the excellent harbors, afforded by the irregular coast line, made it easy for them to launch their ships and carry abroad their manufactured articles. In fact, being everywhere so near the ocean, they early learned to build ships, and came to be known as a nation of seamen. This sea-going habit led to much discovery and exploration by the English people, and finally to permanent settlements both in the new continents and in all other parts of the world.

HARBOR AT QUEENSTOWN

BEN NEVIS MOUNTAINS

Southern and eastern England is a broad, low plain, with occasional ranges of hills. The entire country is beautifully green, there being abundant rainfall throughout the kingdom. Moisture-laden winds sweep over the islands from the warm Gulf Stream of the Atlantic, giving to the country a

much milder climate than we would expect to find in a country so far north.

The mountains of Great Britain are nowhere very high, but they skirt the western coast, and consequently

THE RIVER THAMES AT TOWER BRIDGE, LONDON

get the heaviest rainfall of the island. The highest peaks are in the northern Scottish highlands, which also contain many beautiful lakes. The varied and attractive scenery makes traveling through this country very pleasant.

The rivers are all short, the longest being those that flow across the plain of southern England. These are navigable, and form excellent harbors, making open gateways to and from the islands. London is located upon either side of the River Thames, fifty miles from the open sea, and is the greatest shipping point in the world, having twenty miles of its river front covered by its rows of piers.

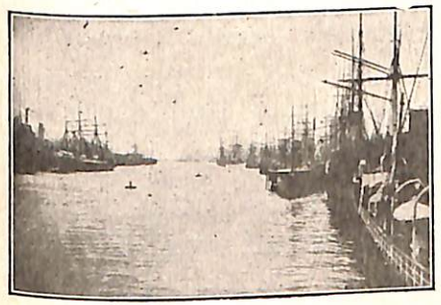
The manufacturing greatness of the British Isles



depends chiefly upon the abundant supply of coal. The deposits of coal, iron, tin, lead, and copper make mining a chief industry. In exchange for manufactured products, such as machinery, hardware, steel ships, and other articles which are shipped from the factories of Great Britain to all parts of the world, raw cotton, wool, hides, and iron are imported. These raw products are made up in the great factories, and again shipped out to all the world. Much cotton and woolen cloth is exported, also choice pottery made from a special kind of clay, and carpets of rare quality.

KILLARNEY LAKES IN IRELAND

Great numbers of people are employed in all this trading and manufacturing, and, since so few are engaged in farming, foodstuffs must be largely shipped in from abroad. About one half of the people in Ireland are engaged in farming, raising grain, potatoes, and garden products, so that Ireland has been called the farm of England; and yet Ireland does not attempt to supply fully the demand for food.



GLASGOW ON THE CLYDE

Glasgow is the second city in size in the kingdom,

and is the center of Scottish trade and manufacture. Liverpool is another commercial center, and is a great seaport. Manchester is the world's greatest cotton manufacturing center, and Dublin is the center of Irish linen manufacture and ship building.

PARLIAMENT BUILDINGS FROM THE RIVER THAMES

Great Britain is a monarchy. Do you know who is the present ruler? The supreme power of the empire is the lawmaking branch, known as Parliament, consisting of two houses. The House of Lords is composed chiefly of the nobles, and the House of Commons is composed of members whom the people elect. The king of Great Britain appoints a governor general for each of the colonies over which he rules, and the colonies elect their own lawmaking bodies.

The English people have not only made themselves famous in commercial and industrial effort, but in missionary effort as well. What man first translated the Bible into English? Many missionaries have gone from these islands, carrying the Bible into the dark regions of the globe. Do you know the names of any of them?

**Spell and define**

| | | | |
|---|---|---|---|
| com mer′ cial | de pos′ its | dis cov′ er y | pier |
| fi nan′ cial | fac′ to ry | ex plo ra′ tion | col′ o ny |
| pos ses′ sion | im′ ports | nav′ i ga ble | in hab′ it ant |
| pop u la′ tion | ex′ ports | Par′ lia ment | re sourc′ es |



**Questions**

1. Why have the British Isles been called the world's work shop?
2. Compare the population of the British Isles with that of the United States.
3. Compare the area of this group with the area of California; Canada.
4. What can you tell of London?
5. Tell what is meant by the United Kingdom of Great Britain and Ireland.
6. What can you say of the colonies of Great Britain?
7. How much of the surface of the globe is covered by the British Empire?
8. What portion of the people of the globe are included as subjects of that great government?
9. What are the principal possessions of that country?
10. What can you say of the early peoples of the British Isles?
11. Describe the climate and the scenery.
12. What do you know of the harbors?
13. Name the most important cities, and tell for what each is noted.
14. Name the chief industries of the country.
15. What are some of the causes that have led to Great Britain's becoming a manufacturing country?
16. State why the climate of the British Isles is warmer than that of other countries no farther north.
17. How has the nearness of the sea influenced the people in their choice of employment?
18. Mention important exports; imports.
19. Tell what you know of the government of Great Britain.

**Note Book Requirements**

1. On page 40, color the map to indicate the highland and lowland regions.
2. Locate the cities mentioned in the lesson.

# Lesson XLI

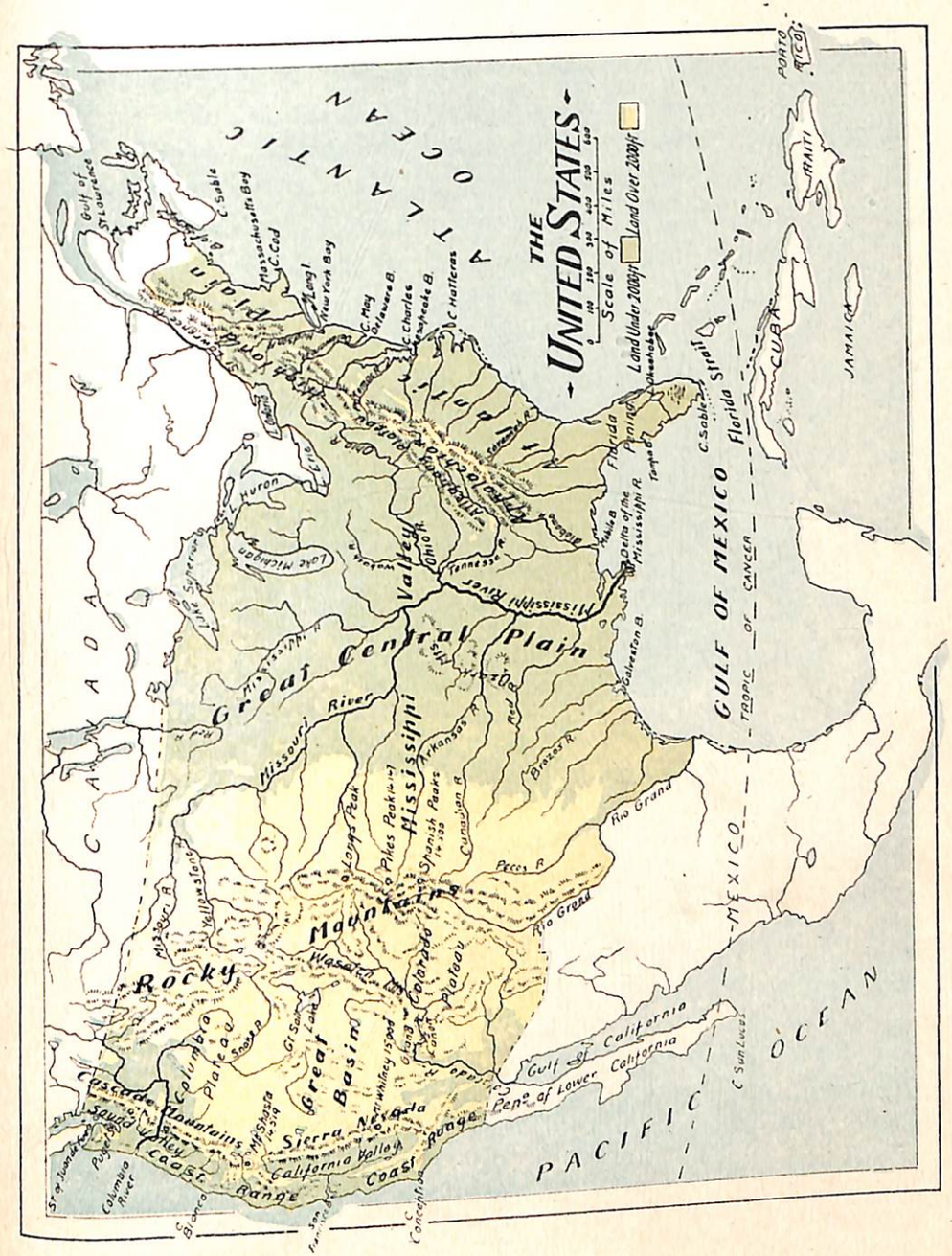
## *Map Study — The United States*

*Position.*— In what continent do we find this political division? In what zone? What oceans wash its shores? What political division is north of it? What gulf and what country are south of it? What waters form a portion of the northern boundary? Using the scale of miles, measure the greatest length and the greatest width of the United States.

PIKES PEAK FROM THE GARDEN OF THE GODS

*Surface.*— Trace the continental divide across the country. What slope is west of this divide? What highland region embraces most of this slope? What mountains border this highland on the west? Toward what arm of the sea does most of that portion of the country slope which is east of this great divide? Trace the eastern divide. What slope is east of it? Find the five chief slopes of the United States. What is the name of the low range of mountains along the Pacific coast? Where are the Cascade Mountains? Find the Allegheny Mountains and the Ozark Mountains. Find two important peaks in the Sierra Nevada range, and three in the Rocky Mountain range.

*Drainage.*— What river drains the great central plain of the United States? Where does it rise, and in what direction does it flow? Name three rivers that empty into the Mississippi from the west, and one from the east.



Name a branch of the Missouri River, one of the Arkansas, and two branches of the Ohio. Name the Great Lakes, and the river that forms their outlet. Name three rivers that flow from the Appalachian Highland into the Atlantic Ocean. What large lake in the Rocky Mountain Highland has no outlet? Describe the Colorado and the Columbia rivers. What river flows from the Rocky Mountain Highland, and empties into the Gulf of Mexico? Of what especial importance is this river?

**Note Book Requirements**

1. On map No. 10, page 41, trace the outline of the United States.
2. Name countries and waters bordering the United States.
3. Locate mountains, and trace the important rivers.
4. Name the highland and the lowland regions of the country.
5. Color the map to show the highlands and the lowlands.

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## Lesson XLII

*The United States*

The United States is the most important country of North America. It occupies the central part of the continent, and extends from the Atlantic Ocean to the Pacific. Here live fully four fifths of all the people of the great North American continent.

The surface of the United States is crossed by all the great highland and lowland regions of the continent, and the continental divide is the main watershed of the country.

Between the vast Rocky Mountain Highland in the West and the Allegheny plateaus in the East lies the great Central Lowland, one of the most fertile regions in the world. Through the center of this great valley, flows the mighty Mississippi.

Near the center of the United States, the Central Lowland merges into the great Western Highland. This Rocky Mountain Highland may be roughly divided into four parallel sections, extending in a general north and south direction across the country: (1) The great plains on the east, (2) The high ranges of the Rocky Mountain chain, (3) The great plateau region, and (4) The high Sierra Nevada and Cascade range along the western border of the highland.

COMMERCE OF THE GREAT MISSISSIPPI VALLEY

Cotton — cotton — cotton, which in the winter is piled in the very streets of the inland towns, crowding all the lines of transportation, has made Galveston and New Orleans rank next to New York in exports. Five great railroad systems and the river are making New Orleans the outlet of the other products of the Mississippi Valley. This photograph shows the square and the round bales of cotton on a wharf in New Orleans.

West of the Sierra Nevada and Cascade Mountains is the narrow Pacific Coast Slope. This region consists of a series of lowland valleys, bordered on the west by a range of low mountains which rise abruptly from the Pacific coast. These valleys are very fertile. The California valleys drain into the ocean by the San Francisco Bay, while in the north Puget Sound cuts into the otherwise unbroken coast line.

In the East is the Atlantic Coast Plain, which is separated into two parts by the Hudson River. South of the



Hudson River, the eastern half of the Atlantic Plain is low, flat, and sandy; while the western part rises more rapidly, forming the knolls and uplands of a foothill region. The larger streams of this section are navigable; while northeast of the Hudson River the Atlantic Plain descends abruptly from the highlands, and hence the streams, abounding in falls and rapids, are not navigable.

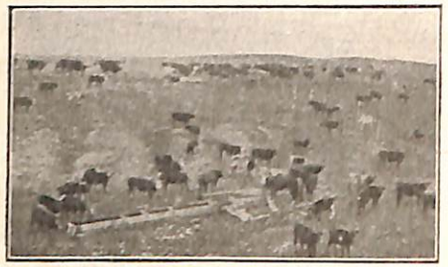
LUMBERING IN OREGON

The United States lies chiefly in the northern part of the North Temperate Zone. In the central part of the country the winters are cold and the summers hot; in the northern part, the winters are cold, but the summers are temperate; in the southern part, the winters are temperate, but the summers are hot; while along the extreme western coast it is always temperate, because the prevailing winds from the Pacific Ocean warm the coast in winter and cool it in summer.

A LUMBER CAMP IN MAINE

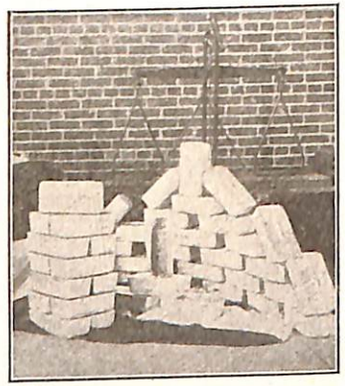
These winds from the Pacific Ocean are moisture-laden, and this accounts for the heavy rainfall along the western part of the United States. As they lose most of their moisture on the western

slopes of the Sierra Nevada and Cascade ranges, the great Western Highland is for the most part left dry, and in some places is a desert. The larger streams of that region are fed by the rains and melting snows of the mountains. There irrigation is necessary for farming.



HERD OF CATTLE ON THE PLAINS

The Atlantic Plain and the great Central Lowland are well watered by the winds from the Gulf of Mexico and the Atlantic Ocean. The fact that there are no high mountain ranges in the eastern and the southern part of the United States, makes it possible for the winds to carry the vapor for hundreds of miles inland. So we see that the Creator planned to make of this great belt of country a fit place for habitation.

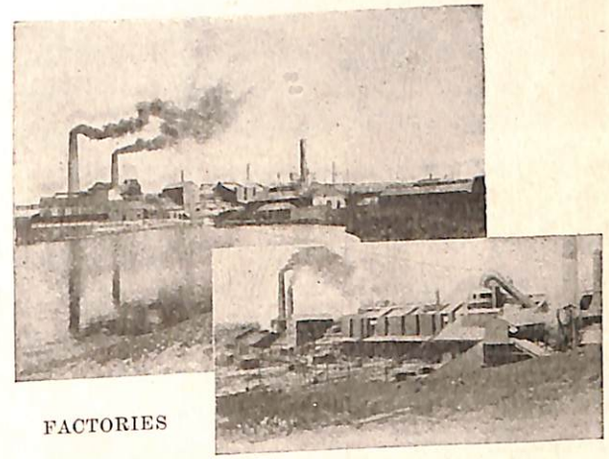


GOLD AND SILVER BULLION AT SMELTER, DENVER, COL.

In the well watered eastern and middle section, and also in the Pacific coast region, more people are engaged in farming than in any other occupation. Corn, hay, cotton, wheat, oats, and potatoes are the principal products. Corn is much the largest and most valuable crop of the United States, and is widely grown both north and south, but the chief yield is in the northern Mississippi Valley. Wheat does not



require as hot summers as corn, and hence is grown farther north. Cotton is an important crop, and three fourths of the world's cotton supply comes from the United States. Other valuable productions of this country are the fruits and vegetables raised in almost every section. Tobacco is raised in the southern part of the United States. It is sad that so much land is devoted to the culture of this weed.



FACTORIES

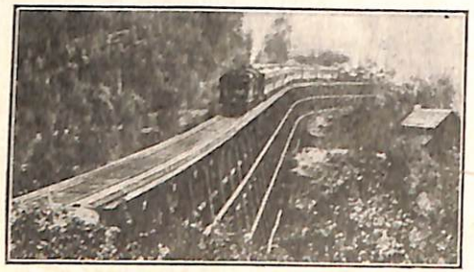
*Herding* is an important occupation in both the great Central Lowland and the Western Highland region. This is because the pasture land is so extensive. About one fourth of the cattle in the world are raised in the United States, and about one half the hogs. Sheep also are raised in great numbers.

*Fishing* is an industry of much commercial value to this nation, and many people work in the fisheries.

*Lumbering* is a prominent occupation, since one third of the lumber cut in the world comes from the forests of this country.

The *mines* of the United States yield about one third of the mineral supply of the world. Of these the coal and iron mines are the most valuable; next to them are petroleum, copper, gold, and silver. Coal is mined chiefly

in the Eastern Highland, while iron is found in nearly every State. Gold and silver are mined in the Rocky Mountains and in the Sierra Nevada Mountains. By far the greatest amount of copper comes from the mines on the south shore of Lake Superior. Petroleum is widely distributed.



RAILROADS ARE USED EXTENSIVELY FOR LAND TRANSPORTATION

The United States is the greatest *manufacturing* country in the world. Nearly every kind of article used by civilized man is manufactured in this country, and generally more cheaply than anywhere else. The greatest manufactures are iron and steel goods, cloth and clothing, lumber, flour, corn meal, liquors, and leather goods. Most of the manufacturing is done in the northeastern part of the country, where towns and cities are more numerous than elsewhere.

UNITED STATES CAPITOL AT WASHINGTON

The commerce of the United States is very extensive. The principal articles of export are raw cotton, meat, breadstuffs, iron and steel manufactures, and kerosene. The chief imports are raw silk and wool, cloth, sugar, and coffee. Other imports are drugs, hides, and India rubber.



Although the foreign commerce of the United States is very important, it forms but one tenth of the entire commerce. Goods must be transported from one part of the country to another. What kind of commerce is this? Nearly half of the world's length of railroads is in the United States; and about three fourths of the goods shipped are sent from place to place by railroad. The rest are sent by boats on the oceans and lakes which border the country, or on the rivers and canals of the interior.

The United States is a republic. The government has three great branches. These are (1) The lawmaking branch, called *Congress;* (2) The law-enforcing branch, the head of which is the *President;* and (3) The law-explaining branch, consisting of courts, over which judges preside. *Congress* and the *Supreme Court* meet in the Capitol at Washington. The President is elected by the people, every four years, and lives in the White House at Washington.

**Spell and define**

| | | | |
|---|---|---|---|
| ker′ o sene | mon′ arch y | pres′ i dent | cap′ i tal |
| re pub′ lic | cap′ i tol | pe tro′ le um | Con′ gress |

**Requirements**

1. Bring to class at least two questions upon every paragraph in your lesson.
2. Collect pictures to illustrate the scenery and industries mentioned in this lesson.
3. Find in your lesson mention of one crop, one manufactured article, one export, and one import which any people could well afford to get along without.

# CHAPTER VI

# PLANTS

*(Scripture Basis, Gen. 1:11, 12)*

*"And God said, Let the earth bring forth grass, the herb . . . and the fruit tree."*

## Lesson XLIII

### *Consider the Lilies*

**Solomon in all his glory was not arrayed like one of these. Matt. 6:29.**

We have already learned that the plants were brought into existence on the third day of the creation week, and that they were pleasant to the sight and also good for food. The plant creation was made not only to provide us with our daily food, but also for us to behold. It was made beautiful — so beautiful that Christ says that even Solomon in all his glory did not compare with the beauty of the lily.

The Creator intended that we should study the plants; and in the words that Jesus spoke when He was on the





earth, the invitation is given to us, "Consider [study] the lilies of the field, how they grow." We are not only told to *study* the plants, but we are plainly told that we should study *how they grow*. Where can we better study the plants, than right out among them? Did not the

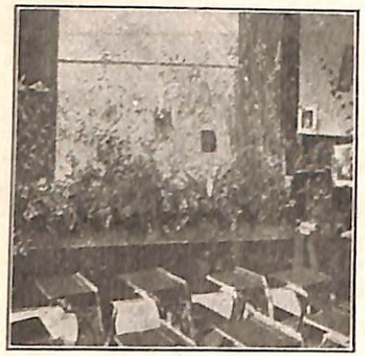
GATHERING WATER LILIES

Creator put the first man and woman into a garden to study and to work? Out in our gardens, among God's beautiful plants, He can teach us lessons that we can not learn in books. Do not be afraid of garden study. Out among the plants, you can better understand many lessons that He wishes to teach.

The Lord says, "I will be as the dew unto Israel; and he shall grow as the lily." Israel, God's people, are to grow as the lily grows. We have an example, in the

growth of the lily, which makes plain to us how the Christian is to grow.

We know that plants will not grow if they are deprived of light, heat, air, and water. These life-giving agencies surround the plant, and it takes them in, and grows. The plant does not have to worry or fret as to how it will grow, but simply receives the blessings by which it is surrounded.



A SCHOOLROOM WINDOW GARDEN

Have you one in your schoolroom?

So it may be with us. We are surrounded by spiritual blessings, which, if simply received into the soil of a good heart, will cause us to grow. We may receive the light of righteousness, the warmth of love, the breath of God's Spirit, and the water of life. All these are given us freely, that we may grow up into Christ. It is plain, then, that we are invited to study the plants of the garden so that we may learn how to grow as plants in the garden of the Lord.

The water lily teaches us a beautiful lesson. On the bosom of some slimy pool, it opens its snowy petals. In spite of surrounding weeds and rubbish, it lifts up its fragrant blossoms. Whence its fragrance and purity? May not our lives be as pure and as cheering as the beautiful, fragrant lily?

As we study the different plants, we see in them the great wisdom and power of God. Each part of the plant shows perfection; and the more closely we study these



parts, using not only our eyes but also a magnifying glass, the greater the perfection appears. These plants remind us continually that God loves the beautiful.

How many kinds of plants there are! The most beautiful are often modest and unpretentious, like the violet and the buttercup. So the most beautiful characters are not those who make a great display, but those who modestly and constantly give out the sweet fragrance of Christian character.

When we consider the many uses of the plant as related to man and the lower animals, we see God's love for His creatures. The great variety of fruits, grains, and nuts, furnish man and the lower animals with an abundance of wholesome and palatable food.

### Questions

1. On which day were the plants created?
2. For what two purposes were they made?
3. How does the lily's beauty compare with artificial splendor?
4. Does the Creator design that we should study the beautiful plant creation?
5. Where in the Scriptures is this invitation found?
6. What are we to learn in the study of plants?
7. What other kind of growth does the growth of the plant help us to understand?
8. What are the four agencies of plant growth?
9. How does the plant grow?
10. What are the agencies of Christian growth?
11. How does the Christian grow?
12. What is revealed as we study the various parts of the plants?
13. What lessons do the plants teach us with reference to the building of character?

**Note Book Requirement**

On page 42 of the Note Book, answer the preceding questions.

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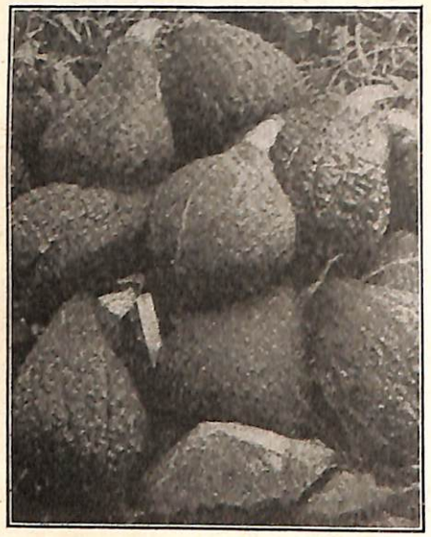
# Lesson XLIV

## *The Squash Seed*

**Whatsoever a man soweth, that shall he also reap. Gal. 6: 7.**

Wrapped snugly within every stout seed coat, sleeps a miniature plant, or *embryo*, in kind like the parent plant from which it fell. It is the office of every seed to produce a new plant; and if you will place seeds in moist, warm earth or sawdust, and examine carefully the awakening plantlets from day to day, you will be rewarded with a knowledge of much that is curious and interesting in plant behavior.



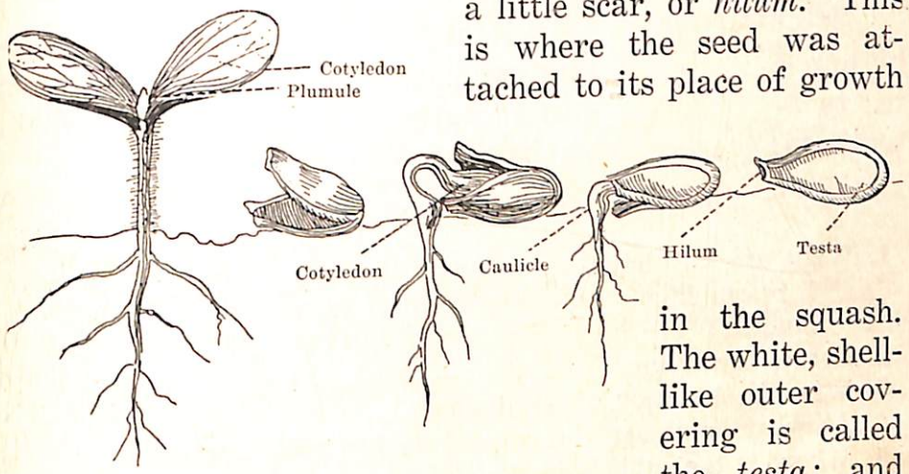
WARTED HUBBARD SQUASHES

Let us see what we can learn from the squash seed. Soak some squash seeds in tepid water for twelve hours or more. Plant some of these one inch deep in damp sand or damp pine sawdust. Put the box in a warm place (not at any time over 70° or 80° Fahrenheit). Keep the sand or sawdust moist but not



wet, and the seeds will sprout. Examine the sprouting seeds from day to day. In the course of a week or ten days a colony of young plants will arise and straighten themselves up like the one in the picture.

At the pointed end of the squash seed you will observe a little scar, or *hilum*. This is where the seed was attached to its place of growth in the squash. The white, shell-like outer covering is called the *testa;* and closely covering the kernel of the seed is a greenish inner skin called the *tegmen*.




Having stripped from the kernel the testa and the tegmen, you may next examine the embryo. Notice that at one end it tapers to a point. From this pointed portion, known as the *caulicle*, will develop both the stem of the plantlet and the root.

The halves of the kernel are called the *cotyledons*. These are attached for a little way next to the caulicle; and at this point, lying between the two cotyledons, are two very slender, pointed objects — the leaves of the *plumule*, or first bud.

The seed is a symbol of Jesus. Just as the seed must be placed in the earth and die before the new life within can spring forth, so the Saviour laid down His life, and tasted death for all. This He did that He might bring many sons and daughters out of the prison house of death.

**Spell and define**

| | | |
|---|---|---|
| hi′ lum | Fah′ ren heit | cau′ li cle |
| tes′ ta | min′ i a ture | cot y le′ don |
| teg′ men | em′ bry o | plu′ mule |

**Questions**

1. What are the shape and color of the squash seed? How does it resemble and how does it differ from other seeds already studied?
2. Locate the hilum.
3. What is the color of the tegmen?
4. At what point are the cotyledons fastened together?
5. Where is the caulicle in the squash seed?
6. Which end of the seed develops the root?
7. Which end should be placed downward when the seeds are planted?
8. Compare the cotyledons of the squash with those of the bean.
9. Do the cotyledons shrink up and drop off, or do they become permanent leaves?
10. In what way does the seed remind you of the Saviour?

**Note Book Requirements**

On page 43, make the following drawings:—

1. A squash seed, showing the hilum.
2. The two cotyledons connected with the caulicle.
3. A cross-section of the squash seed, showing the testa, the tegmen, and the cotyledons.



4. The uncovered kernel, showing the caulicle and the veins.
5. Four stages in the growth of the seedling.

These drawings should be made about two days apart.

---

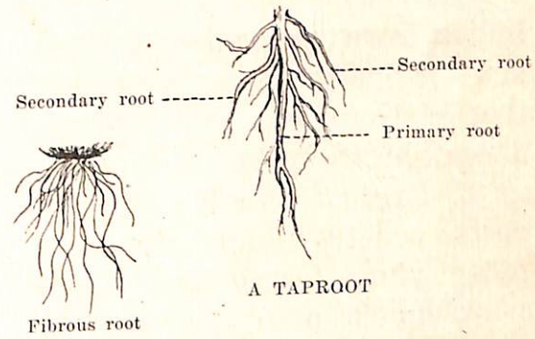
# Lesson XLV

## *Kinds of Roots*

**The root of the righteous shall not be moved. Prov. 12:3.**

In the study of the roots of various plants, we notice the following kinds:—

1. *Primary Roots.*—The stem is usually supported by one large main, or primary root, sometimes called the taproot. Primary roots are divided into two classes: (a) *Non-fleshy roots*, which are hard and tough, consisting largely of woody fiber; and (b) *Fleshy roots*, which are soft and juicy. These are variously shaped. Some fleshy roots are *conical*, some are *napiform*, and some are *fusiform*. Conical roots are shaped like an inverted cone. The parsnip and carrot are examples of this kind. Napiform, or turnip-shaped roots are largest near the top, but taper off very abruptly. Two good examples of these are the beet and the turnip. The



fusiform, or spindle-shaped roots are those largest in the middle but tapering gradually toward both ends. The radish is the most common example. All these fleshy roots store away an extra amount of food. This is of value not only to the plant, but to animals.

FUSIFORM ROOT

CONICAL ROOT

NAPIFORM ROOT

2. *Secondary Roots.*— The branches of primary roots are called *secondary roots.* These are valuable food gatherers.

Some plants, as Indian corn and other grasses, instead of having one large primary root, send out many small threadlike roots. These are called *fibrous roots.* The onion produces fibrous roots.

3. *Parasitic Roots.*— Some roots penetrate the stems of other plants, and draw their nourishment, or food, from them instead of getting it first-hand from the soil. The dodder and mistletoe are examples of parasitic plants. The mistletoe obtains its nourishment entirely from the tree to which it clings. These beggar plants can be seen sitting upon the limbs and branches of such

MISTLETOE

The mistletoe clings to the oak by means of parasitic roots.



trees as the oak. Sometimes several are found on one tree.

The dodder is a plant parasite. It starts out well in life, taking its nourishment from the soil; but after a time it leans against some tree, and throws out small roots, which grow into the bark and draw food from its host. Finally the stem of the dodder decays at the point where it connected with the root in the ground, the plant thus becoming weak and helpless, depending on others for support and food.

There are three classes of plants, as regards the source from which they secure their food: first, those gathering it from the soil; second, those obtaining it from other living plants; third, those getting their nourishment from decayed vegetation, as do toadstools and mushrooms.

These three classes of plants represent three classes of people. To which class do you belong? All those having "no root," will fall away. The Bible says it is possible for us to be "rooted and built up" in Jesus.

**Spell and define**

pri′ ma ry
sec′ ond a ry
con′ ic al
fu′ si form
cone
na′ pi form
fi′ brous
par a sit′ ic
dod′ der

**Questions**

1. What is the work of the roots?
2. Name the different kinds of primary roots, and give an example of each.
3. What is a secondary root?
4. What plants have fibrous roots?

5. How does a parasitic plant differ from other plants?
6. What is a parasitic student?

**Note Book Requirements**

1. At the bottom of page 44 make a drawing of a carrot, a turnip, and a radish.
2. Make a drawing of the corn root.

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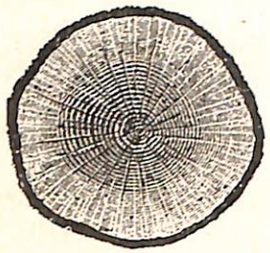
## Lesson XLVI

*Kinds of Stems*

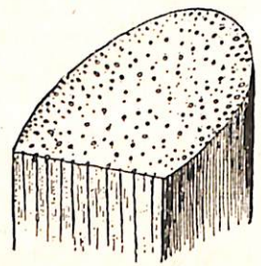
**There shall come forth a Rod out of the stem of Jesse, and a Branch shall grow out of his roots. Isa. 11:1.**

A plant usually grows in two directions — upward and downward. The part growing downward is the root; and the part growing upward is the *stem*, which sometimes is called the trunk, or stalk, of the plant.



CROSS-SECTION OF EXOGENOUS STEM

As to the inner structure of stems, there are two kinds, which can be easily observed by making a cross-section of the stem. If we saw off a block from an oak or an ash log, or from the trunk of any common tree, we shall observe that the end of the block contains numerous rings, from the large one near the bark to the small one surrounding the *heart* of the trunk. Each ring represents a definite period of growth; and by



CROSS-SECTION OF ENDOGENOUS STEM

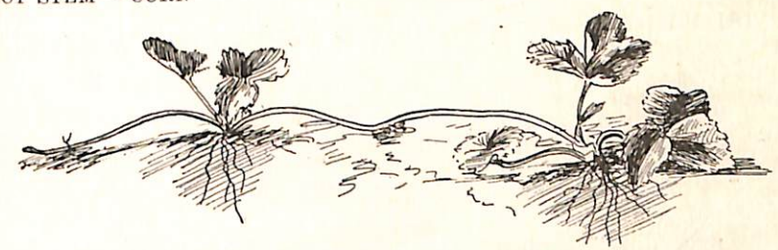


counting the rings, we can usually find out the age of the tree. The outer ring represents the last period of growth. The stems developing on this plan of growth are called *exogenous*, which means, *growing on the outside.* The great majority of plants have exogenous stems. The ringlike structure of small plants can be seen by the use of a magnifying glass.

The stems of corn and other grasses, also that of the palm, do not have this ringlike arrangement; but the woody fibers, instead of being placed in a circle, are scattered irregularly through the stem, and the newest growth takes place in and near the center. For this reason, these stems are called *endogenous*, which means, *growing on the inside.*

The illustrations will give you

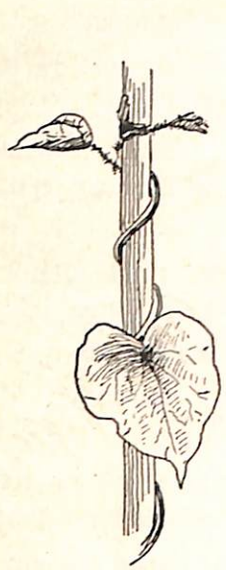
ERECT STEM — CORN



CREEPING STEM — STRAWBERRY

some idea of the cross-section appearance of these two classes of stems; but do not be satisfied with this brief description of the two kinds of stems, together with a glance

at the pictures illustrating them. Get a saw, and saw off a block from the trunk of some tree, and examine it.



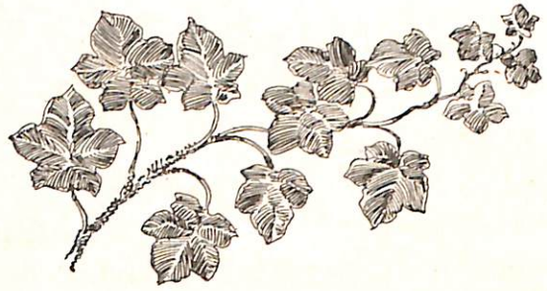
TWINING STEM — MORNING-GLORY

DIFFUSED STEM

ASCENDING STEM

Next take an old cornstalk, and with a sharp knife cut around it just through the outer covering; then pull apart, and you will see the irregular arrangement of the fibers.

PROSTRATE STEM



CLIMBING STEM — THE IVY



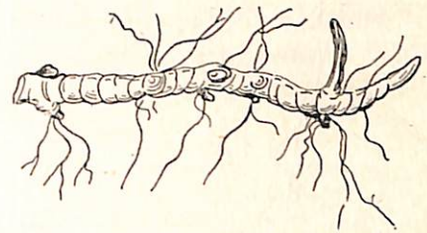
Not all stems grow straight upward, any more than do all roots grow straight downward. In looking at the stems about us, we find them in these various positions:—

*Erect*, growing straight upward or nearly so.

*Diffused*, loosely spreading in all directions.

*Declined*, bending to one side.

*Prostrate*, lying on the ground.



UNDERGROUND STEM — A ROOT STALK

*Creeping*, crawling along on the ground or just beneath it, and striking root several times, as white clover.

*Ascending*, rising obliquely.

*Climbing*, ascending by clinging.

*Twining*, coiling around stems or other supports, as the hop and the morning-glory.

*Underground*, growing beneath the ground, as do potatoes and lily bulbs.

**Questions**

1. What is a stem?
2. What is its purpose?
3. In what way does it differ from the root?
4. Collect and describe several different kinds of stems.
5. Name the two great classes of stems, and describe the structure of each.
6. State the directions of growth of some of the more common stems.
7. What classes of people might be represented by these stems?
8. Which stem represents you in the getting of your lessons?
9. What stem represents the relation we should sustain to Christ?

10. Read Ruth 4:22 and Matt. 1:1, and see if you can explain the lesson heading text.

**Note Book Requirement**

On the upper part of page 44 make drawings of stems, to show their manner of growing.

---

## Lesson XLVII

### *Branches and Their Arrangement*

**Abide in Me, and I in you. As the branch can not bear fruit of itself, except it abide in the vine; no more can ye, except ye abide in Me. John 15:4.**

The stem divides into what are called *branches*. You will find, by careful observation, that the branches upon many plants are arranged in a very regular way. Three of the most common plans of arrangement are:—

BIG GRAPEVINE

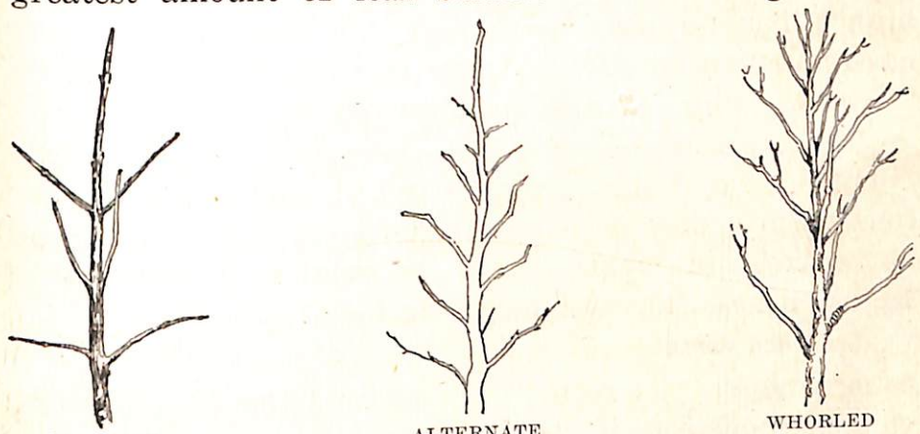
The largest in the world, at Carpinteria, California,— girth one hundred inches

1. *Opposite.*— In this plan, the branches are always found opposite one another. The maple tree is a good example of this arrangement.

2. *Alternate.*— Here the branches are on *nearly* opposite sides of the stem, but *not* opposite each other. They will be found to form a more or less spiral line about the stem. In some trees the spiral is made more rapidly



around the stem than in others. In the apple, pear, cherry, poplar, and oak, one passes over five spaces, before coming to a branch which is over the first one; and in doing this, two complete turns are made about the stem. This alternate plan permits the plant to present the greatest amount of leaf surface to the sunlight. The



OPPOSITE BRANCHES

ALTERNATE BRANCHES

WHORLED BRANCHES

opposite arrangement allows a large amount of sunlight to come to the leaves of plants, but not so much as the alternate.

3. *Whorled.*— This arrangement is the same as the opposite, only that several branches form a circle about the stem. This exposes less leaf surface to the sunlight than does either the opposite or the alternate plan.

Most trees and shrubs have the alternate order, while the herbs have the opposite and whorled. The wisdom of the great Designer is seen in His devising such ways for admitting the sunlight as the different trees, shrubs, and herbs individually need. In our study thus far of the branches, we find that they are regularly placed,

giving beauty and symmetry to the plant. The connection between the branches and the stem is perfect; for they are a part of the stem, and not something tacked on.

What a wonderful lesson we learn from the branches in their relation to the stem! Apart from the stem, the branch has no life; and apart from the Saviour, we have no spiritual life. As expressed in His own words, "I am the vine, ye are the branches."

The branches of some trees are very irregularly distributed, so that they are deprived of much sunlight; and consequently they do not bear the fruit they might. Let us be trees of righteousness, so related to the Sun of Righteousness that we may bear much fruit.

**Spell and define**

| | | | |
|---|---|---|---|
| ex og′ e nous | e rect′ | as cend′ ing | climb′ ing |
| en dog′ e nous | dif fused′ | pros′ trate | creep′ ing |
| fi′ ber | de clined′ | ob lique′ ly | twin′ ing |

**Questions**

1. What is the origin of the branch?
2. Describe three plans of branch arrangement.
3. Mention trees that are examples of each plan.
4. Which allows the greatest amount of sunlight to reach the leaves and fruit?
5. Which admits the least amount of light?
6. What lesson did Jesus teach from the relation of the branches to the stem?

**Requirement**

Make a collection of stems and branches illustrating the three plans of arrangement.

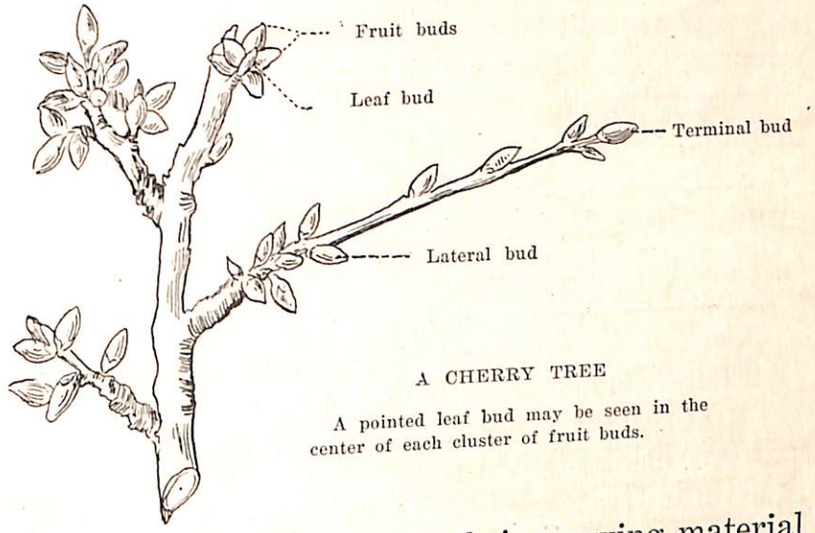


# Lesson XLVIII

## *Kinds of Buds*

For there is hope of a tree, if it be cut down, that it will sprout again, and that the tender branch thereof will not cease. Though the root thereof wax old in the earth, and the stock thereof die in the ground; yet through the scent of water it will bud, and bring forth boughs like a plant. But man dieth, and wasteth away: yea, man giveth up the ghost, and where is he? Job 14: 7-10.

One of the main differences between a stem and a root is that the stem develops buds, while the root does not. A stem may grow below ground, as in the case of the potato; and a root may grow above ground, as is shown by




A CHERRY TREE

A pointed leaf bud may be seen in the center of each cluster of fruit buds.

the tropical air plants that gather their growing material from the air.

In this lesson we shall notice a few things about buds. Observe first that a bud is a part of the stem, which,

while remaining vitally connected with the stem, yet grows away from it, having a definite work to accomplish. It is the work of some buds to develop leaves; others develop flowers; and still others, both leaves and flowers. The beginning of every branch is a bud; and the branch, as it grows, makes room for more buds, which will develop leaves and flowers. The flowers in turn develop into fruit; and the fruit contains the seed, which, when buried in the soil, brings forth another plant of the same kind.

Now the great aim of every plant is to bear fruit; yet every stage of development,— the root, the stem, the branch, the bud, the leaf, the flower, the fruit, the seed,— serves a useful purpose. This should be true in our development as plants in the garden of the Lord.

According to their structure, buds are named as follows:—

*Scaly buds*, those which are provided with scales to protect them from the cold.

*Naked buds*, those which have no scales. In tropical regions the buds are not covered. Why?

*Leaf buds*, those which produce leaves only.

*Flower buds*, those which produce flowers only.

*Mixed buds*, those which develop both flowers and leaves. The buds which will develop first into flowers and then into fruit, can be easily recognized by their being shorter and thicker than the leaf buds.

A bud growing at the end of a twig or stem is from its position known as a *terminal* bud, while one growing from the side of the stem is a *lateral* bud. Buds growing in a leaf axil — that is, between the leaf and its branch — are called *axillary* buds.



As in the study of the branches, you should go out into the fields and woods, and see with your own eyes what you have been told, and much more, too. Bring in twigs from the orchard in the early springtime. Place these in water in a sunny window and watch the opening of the buds. Your own life is but a bud. All that is hidden in your heart will one day be spread open to the gaze of all, as are the leaves and petals of the sleeping buds. Every bud has its own special work; and likewise every child has his own field of usefulness.

### Questions

1. What is a bud?
2. Of what parts is it composed?
3. What is one of the main differences between a root and a stem?
4. What is the relation of a bud to the stem? of the bud to the branch?
5. Give the names of the various kinds of buds as to their position on the stem and branches.
6. Name the different kinds of buds as to their structure.
7. What lessons do you learn from the story of Aaron's rod that budded, blossomed, and bore fruit, after it was separated from the almond tree?
8. What other lessons have the buds taught you?

### Requirement

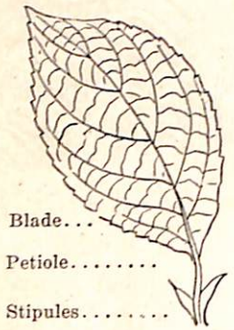
On stiff cardboard, twelve inches long and ten inches wide, mount stems or twigs bearing the different kinds of buds studied in this lesson. They can be either glued or sewed onto the cardboard. Write underneath each stem or twig the kind of buds it bears.

# Lesson XLIX

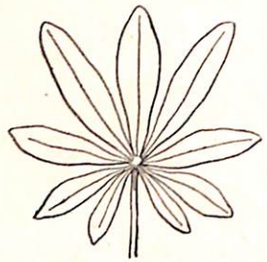
## *Review Study of Leaves*

**Now learn a parable of the fig tree; When his branch is yet tender, and putteth forth leaves, ye know that summer is nigh. Matt. 24: 32.**

*Arrangement.*— What marks the place where each of last year's leaves grew? How will the leaves of this year's growth be related to these leaf scars? Name three ways in which leaves are arranged on the branches. Give as many examples of each as you can.

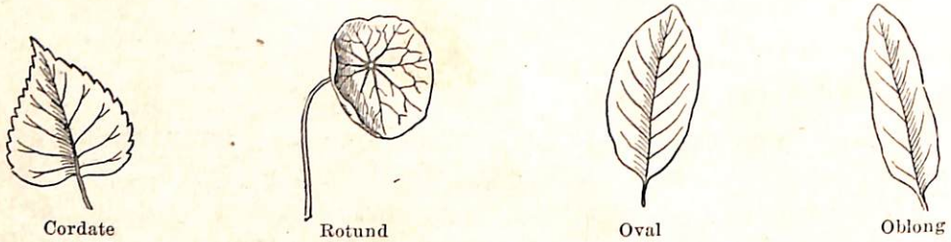


A SIMPLE LEAF


COMPOUND LEAF

*Parts.*— How many parts has a leaf? Name them. Which of these parts is often lacking? Give an example of a leaf in which all the parts are present. Mention a leaf in which two of the parts are lacking.

*Kinds.*— What is the difference between a *simple* leaf and a *compound* leaf? Name examples of each.



LEAF SHAPES



*Shapes.*— Describe a leaf *rotund* in shape. Give examples of this kind of leaf. What is meant by a *cordate* leaf? Name one. Mention leaves that are *oval* in shape. Name some that are *oblong*.

**Spell and define**

| | | |
|---|---|---|
| du ra′ tion | whorled | sim′ ple |
| ar range′ ment | stip′ ule | com pound′ |
| al′ ter nate | pet′ i ole | ro′ tund |
| op′ po site | blade | o′ val |
| cor′ date | vein | ob′ long |

**Requirements**

1. Collect and bring to class leaves that will illustrate all the facts you have learned about leaves.
2. Press and mount one of each of the four shapes mentioned.

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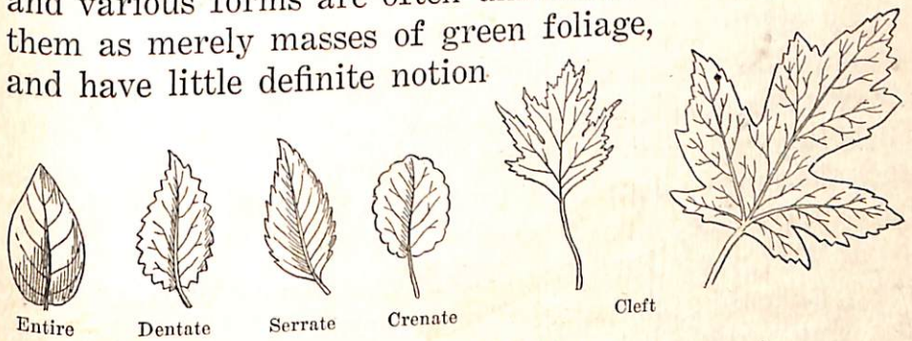
# Lesson L

## *Forms of Leaves*

Leaves are such common things that their interesting and various forms are often unnoticed. Many people see them as merely masses of green foliage, and have little definite notion



LEAF MARGINS

of many of their individual shapes. And yet how many leaf shapes there are! In a single walk in the garden, or through the forest, you may gather scores of different patterns, and a comparison of their forms will surprise and please you.

In comparing the leaves of different plants, you will notice that their shapes depend a good deal upon the way in which the veins spread themselves through the leaf. If the leaf is thick and narrow, the veins are not so prominent; but if the leaf is wide and thin, the veins are very numerous. Such thick, glossy leaves as those from the orange tree and the India rubber tree, do not need the support that the thin, broad leaves of the pumpkin vine need. The arrangement of the framework of a leaf is always such as to strengthen the leaf most in just those parts that most need to be strengthened.

IN THE WOODS

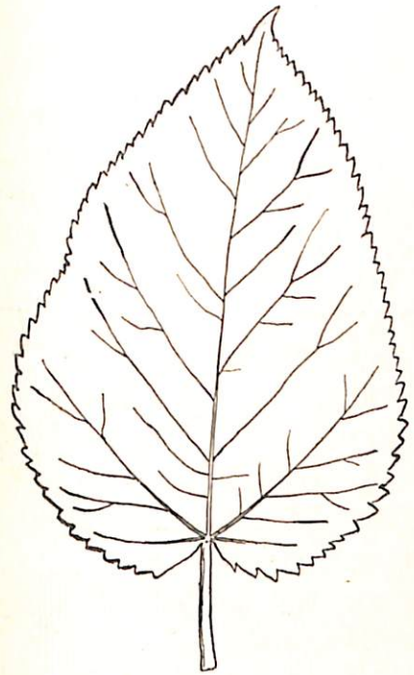
By holding up a thin leaf toward the light, you can see how the main veins are connected by smaller veinlets all over the blade, forming a sort of delicate lacework. Such leaves are said to be *netted-veined*. The elm leaf and the maple leaf are both netted-veined; but notice how unlike they are in shape.

In the maple leaf, the prominent ribs spread out from the petiole like the fingers of a hand; while in the elm, the single midrib is continued from the base to the tip



of the leaf, and from it smaller veins extend obliquely to the edge, like the barbs of a feather.

The elm leaf, and all leaves similarly veined, are said



APPLE LEAF

MAPLE LEAF

to be *pinnately veined*, or feather-veined; while the maple and similar leaves are said to be *palmately veined*.

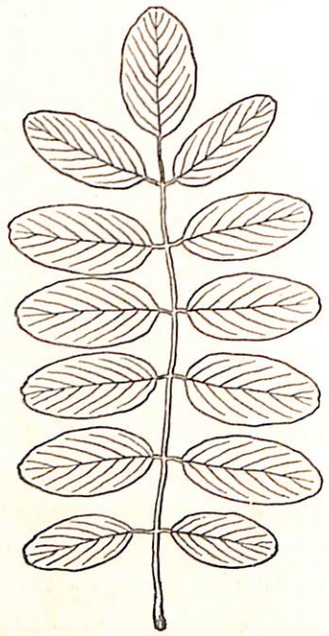
There are many great groups of plants, such as the lilies and the grasses, that have leaves which are neither pinnately nor palmately veined, but instead, because the veins run nearly parallel in the blade, are said to be *parallel veined*. These parallel veins may have either of two arrangements. In some leaves the veins run nearly

PARALLEL VEINED LEAF

parallel lengthwise through the blade; and in other plants, as the canna, the parallel veins branch from a midrib and cross the leaf sidewise.

Leaves having the blade in one piece are said to be simple. The elm leaf is an example of a simple leaf, although the margin is somewhat cut into. In the maple the margin is cut still farther toward the bases of the veins. In some leaves the gaps between the parts are even deeper than in the maple leaf; and in palmately veined leaves they often extend all the way down to the petiole. Yet all these leaves are simple leaves, but we describe them by saying that their margins are cleft, or parted, or even divided, as the case may be.

There are still other leaves whose petiole — as shown in the drawing of the horse-chestnut leaf — or midrib — as shown in the drawing of the locust leaf — bears what appear to be separate leaves. These parts are not, however, separate leaves, but must be taken all together to make up the complete leaf. Such leaves are known as *compound* leaves, and the separate parts are known as *leaflets*.



PINNATELY COMPOUND LEAF

Leaves may be pinnately compound or palmately compound, according to the arrangement of the veins. The clover leaf and the horse-chestnut leaf are examples of palmately compound leaves; while the locust is a good example of a pinnately compound leaf.



Some leaves are *twice compound*. Here is a drawing of a twice compound, or *bipinnately compound* leaf. A leaf may also be *thrice compound*. Such leaves are *tripinnately compound* leaves. Their leaflets divide twice instead of but once, as you can see in the drawing.

PALMATELY COMPOUND LEAF

TRIPINNATELY COMPOUND LEAF

BIPINNATELY COMPOUND LEAF

The leaflets of a compound leaf are always arranged horizontally, without any twist in the stalk of the leaflet; and their location on the midrib does not follow the plan of the leaf arrangement on the stem. There are usually buds in the axil of a leaf, but there are no buds in the axils of the leaflets.

As you study the leaves, and notice their variety of shape, it will be interesting to collect and press samples of all the curious and beautifully notched leaf patterns

in your neighborhood. While studying the leaves, do not forget that upon every leaf is written a message. Do you know what that message is?

**Questions**

1. Name ten plants with which you are familiar.
2. Describe the leaf arrangement upon the stem of each.
3. Tell whether all the leaf parts are present or not in each leaf.
4. State whether the leaf is simple or compound.
5. Describe the framework of each leaf.
6. What is the difference between a pinnately compound leaf and a bipinnately compound leaf?
7. How does a tripinnately compound leaf differ from these?
8. How is the infinite wisdom of God shown in the leaves?

**Requirement**

Press a few of the leaves of your neighborhood, and mount them on sheets of paper. Below each mounted specimen copy a leaf description, telling name, arrangement, kind, venation, shape, and margin of leaf.

**Note Book Requirements**

1. On page 45 write the answer to the last question.
2. On pages 46 and 47 are illustrations of leaf forms and leaf margins. Below each write the names of common leaves of your acquaintance having similar shape and similar margin.

Ovate Lanceolate Obovate Oblanceolate Obcordate



# Lesson LI

## *Purpose of Leaves*

**Now in the morning as He returned into the city, He hungered. And when He saw a fig tree in the way, He came to it, and found nothing thereon, but leaves only, and said unto it, Let no fruit grow on thee henceforward forever. And presently the fig tree withered away. And when the disciples saw it, they marveled, saying, How soon is the fig tree withered away! Matt. 21:18-20.**

The leaf shapes are beautiful, and their margins are a continual surprise; but more interesting yet is the living leaf, unconsciously adapting itself to its surroundings, and fulfilling the purpose for which the great Creator designed it.

Of what use are leaves? The story is told of a man who once stripped off all the leaves from his grapevine in order to give the grapes a better chance to grow. He thought that it was a great waste for so much sap to be used up in the leaves of the vine, and that if he took away the leaves, all the sap would go into the grapes and make them very large. Now, this man learned to his sorrow that not only did the grapes *not* grow any larger, but they stopped growing altogether, wilted, and dropped off.

FIG ORCHARD IN WINTER

When the grapevine is not making fruit, it can get

along very well without leaves, for it is then resting. It has a sufficiently large supply of food for the winter vacation; but no sooner does the sap stir in the buds in the springtime, than the leaves come forth and bestir themselves to assist in more food manufacture.

The leaves of all ordinary leafy plants are the chief organs of the plant for catching the air and the sunshine, both of which are essential to plant life.

Breathing is necessary to the life of the plant. Just as the blood in animals must be put into good condition by going to the lungs, so the sap of the plant must meet the air in the leaves and be put into good condition for its work of building up the various parts of the plant. The plant takes from the air not only breath, but food, for it gets as much food from the air as from the earth; so that the leaves are not only the *lungs* of the plant, but must assist the roots in their work of taking in food.

The light has a great deal to do with both the breathing, and the preparing of the sap for plant food. You have doubtless noticed how plants seek the light. They lean toward the quarter from which the strongest light comes, and the leaf petioles turn with the plant. By shifting the position of a plant, the youngest portions may be made to bend in the opposite direction.

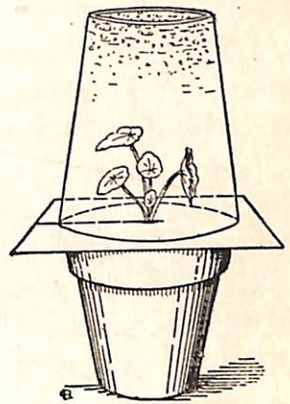
It is not easy to explain just why the leaf must have the light, but it has been found that no food making can be carried on without sunlight.

In the daytime, the leaves take in the impure air which is constantly thrown off from the decaying substances and from the lungs of animals, and give out the



gas which animals must breathe in. So all day long, lungs and leaves carry on a kind of trade; but when darkness falls, the exchange is over for the day. The plants are inactive during the absence of light. They rest until the day's return, when we find them on duty again.

Another use of the leaves is to make the air soft with moisture. Large amounts of water are constantly given off by the leaves of plants. You know that it is the sap in the leaf that keeps it from wilting; and you know, too, that when broken from the plant, all foliage will soon droop and shrivel up. If, however, you place the leaves and flowers in water, they will retain their freshness for some time. And have you not noticed that day after day the water becomes less and less in the dish?



MOISTURE THROWN OFF BY THE LEAVES

It has been found that a medium-sized elm tree, having about seven million leaves, will give off more than seven tons of moisture in twelve hours of clear, dry weather. Long pasture grass has been estimated to give off more than one hundred tons of water to the acre in twenty-four hours. And yet all this moisture is invisible, and passes unnoticed into the air.

How quietly do all these things go on about us! What a great amount of work is constantly done by the leaves, each little leaf doing its share, and contributing to the great good that all together are able to accomplish.

And then, when their work is done, when the fruit is ripened and the sap no longer needs the air and sunlight, how gracefully they close up their work and flutter earthward, each leaving a tiny waterproof scar upon the twig where it lived and worked. And although the falling leaf is a reminder of sin and its results, yet even at death the leaves glow with beauty and color, as if each wished to be a bright promise of a returning spring.

The fruit-bearing trees are not given their leaves simply for display. This is especially true of the fig tree, because the leaves do not appear upon that until the blossoms have opened within the tiny fig. Trees which bear leaves only are a symbol of people who spend all their time and strength in display. Such people accomplish nothing worthy of life. They bear no fruit. Leaves are valuable to the fig tree for one purpose only — fruit-bearing. Learn a lesson from the fig tree, boys and girls.

**Questions**

1. Of what use to a plant are leaves?
2. Tell of all the many ways you can recall in which leaves are a benefit to us.
3. Do you see any wisdom in God's arrangement between the plant creation and the animal creation?
4. What do these quiet little workers teach you?
5. What lesson do you get from Matt. 21: 18-20?
6. How can you prove that leaves require light?
7. What two peculiarities of fig trees are mentioned on this page?

**Note Book Requirement**

On pages 48 and 49 copy your answers to the above questions.



# Lesson LII

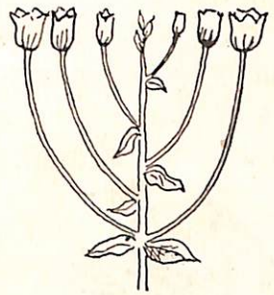
## *The Arrangement of Flowers*

**The grass withereth, the flower fadeth: but the word of our God shall stand forever. Isa. 40: 8.**

Let us now go into the garden and study the flowers. These, as well as the leaves, develop from the buds. God has many ways of arranging the flowers on His different plants; and we are going to notice first a few of the most common plans of arrangement.

Flower buds, like leaf buds, occur regularly either in

RACEME OF CURRANT



CORYMB

UMBEL OF CHERRY BLOSSOMS

the axils of the leaves or at the ends of stems or branches.

The simplest arrangement for flowers that arise from the axils of leaves is that where a single flower springs from each leaf axil. Here is a drawing that shows this plan in a plant with opposite leaves. As long as the stem continues to grow, new leaves may be followed upon it by new flowers.

Examine the lily of the valley and the larkspur. These

flowers grow in what is known as a *raceme*. The flower handles, or *pedicels*, are nearly equal in length.

SPIKE OF PLANTAIN

Examine the hawthorn, sheep laurel, and trumpet creeper. In these flowers the lower pedicels are lengthened so that the lower flowers are brought up to nearly the level of the uppermost, making a nearly flat-topped cluster. Flowers growing upon the plant after this plan are said to be in *corymbs*.

A quite different plan of arrangement is seen in the parsnip and milkweed. Here all the pedicels proceed from one point of the stem, and produce what is called an *umbel*.

Flowers having an arrangement similar to the raceme, but provided with a somewhat shorter pedicel, produce what is known as a *spike*. The plantain and the mullein grow in spikes. The *catkin* is like the spike,

CATKIN OF GRAY BIRCH

SPADIX

HEAD OF CLOVER

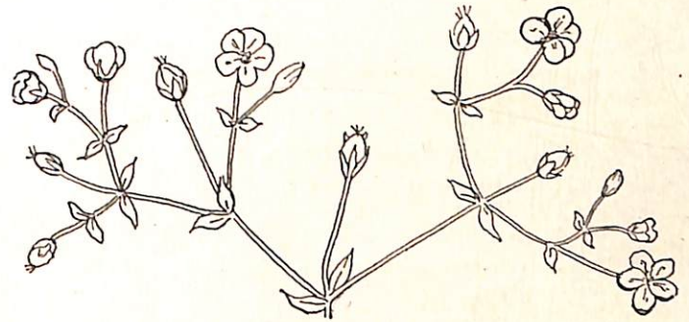
but shorter, having small flowers which spring from scalelike leaves. The birch, the willow, and the poplar all blossom in catkins.



The *peduncle*, or handle, of a spike is often so much shortened as to bring the flowers into a somewhat ball-like mass. This is called a *head*.

Examine the Indian turnip, and you will see that it has an erect, fleshy spike, inclosed in a flowerlike leaf called a *spathe*. Flowers arranged thus produce a *spadix*.

The terminal bud of a stem may be a flower bud. In



CYME

this case the stem may bear but one flower, at its summit; or it may bear several. Very often flowers appear from lateral buds below the terminal flower, and thus give rise to a flower cluster called a *cyme*. This may look very much like an umbel; but in the umbel the order of flowering is from the outside inward, while in the cyme the central flower is the oldest, and therefore the order of blossoming is from the center outward.

**Spell and define**

| | | | |
|---|---|---|---|
| ax′ il | spike | um′ bel | spa′ dix |
| ra ceme′ | ter′ mi nal | cat′ kin | cyme |
| cor′ ymb | pe dun′ cle | ped′ i cle | head |

**Note Book Requirement**

On page 50 make drawings to illustrate all the flower arrangements with which you are familiar.

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## Lesson LIII

### *The Shapes of Flowers*

Let the brother of low degree rejoice in that he is exalted: but the rich, in that he is made low: because as the flower of the grass he shall pass away. James 1: 9, 10.

Gather several different kinds of flowers, and notice carefully the plan upon which the petals are put together to form the complete *corolla*. Here again we find infinite variety and shape.

ROTATE COROLLA OF POTATO BLOSSOM

1. The potato flower is *rotate*, or wheel-shaped. All flowers thus shaped are called *rotate* flowers.

SALVER-SHAPED COROLLA OF JASMINE

2. The phlox and all similar blossoms are said to be *salver-shaped*.

3. The *bell-shaped* blossoms are those having the form of a bell, like the harebell and the bluebell.

4. Some flowers are *funnel-shaped*. The morning-glory is a good example of a funnel-shaped blossom.

5. Such flowers as the trumpet honeysuckle, having about the same diameter from bottom to top, like an ordinary tube, are *tubular* in shape.



6. The pea, bean, and common locust are somewhat like a butterfly in shape, and are called *papilionaceous*.

7. There are *lip-shaped* blossoms, like the dead nettle, the snapdragon, and the toadflax.

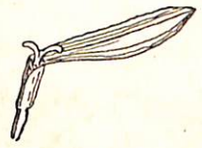
8. *Strap-shaped* blossoms are those in which the petals are long and narrow, like the tiny blossoms of the dandelion and chicory.

BELL-SHAPED COROLLA

You will notice that many of the flowers which you examine have the petals partly or entirely united. Such blossoms are said to be *monopetalous*. The morning-glory and the petunia are examples of monopetalous blossoms.

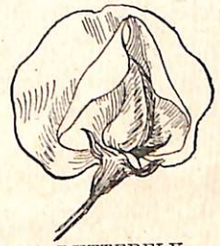
MORNING-GLORY FUNNEL-SHAPED

The flowers are beautiful in shape and texture. They are beautiful in color and arrangement. Nothing that can be done to delight and please is left undone by the Creator. "He hath made everything beautiful in its time." He who clothes the flowers in beauty, desires that we, His children,



DAISY STRAP-SHAPED

SNAPDRAGON LIP-SHAPED



A BUTTERFLY-SHAPED BLOSSOM

HONEYSUCKLE TUBULAR

learn from the blossoms how to honor our Creator in our dress. He who clothes the flowers, teaches us through the frail plant blossoms that our attire should be neat, appropriate, and becoming.

"It is right to love beauty and desire it; but God desires us to love and seek first the highest beauty,"— that which is imperishable. We may choose that "royal robe woven in heaven's loom — the 'fine linen pure and white,' which all the holy ones of earth will wear. This robe, Christ's own spotless character, is freely offered to every one. But all who receive it will receive and wear it here." If we keep our minds open to pure, loving thoughts, and do loving, helpful deeds, we are wearing the beautiful garment of character. Thus we may be made beautiful as the "Rose of Sharon," the "Lily of the Valley;" and our lives will be fragrant and uplifting. "They shall walk with Me in white: for they are worthy." The glory of man is as perishable as the flower of the grass; but beauty of character is imperishable.

**Questions**

1. Why did not the Creator make all flowers after one pattern as regards shape?
2. Name and describe eight flower shapes. Give examples of each.
3. What is the meaning of the word "monopetalous"? Name as many monopetalous blossoms as you can.
4. Why is Jesus compared to a flower? Where is the text?

**Requirements**

1. If possible, find a flower for each shape described in the lesson.
2. Be able to spell the names of these shapes, and to make a drawing to illustrate each.



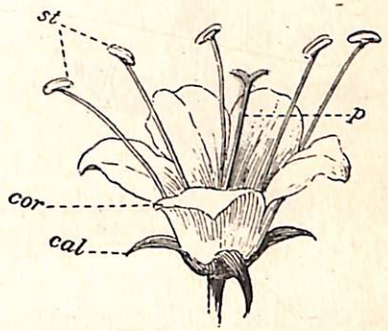
# Lesson LIV

## *The Purpose of the Organs of Flowers*

**And God said, Let the earth bring forth grass, the herb YIELDING SEED. Gen. 1:11.**

Most showy flowers consist of four circles or sets of organs,— the sepals, the petals, the stamens, and the pistils. The sepals, taken together, make the *calyx;* and the petals, taken together, make the *corolla.*

The calyx and the corolla form a protection to the more delicate and important parts of the flower within. We say that the corolla is the most beautiful part of the flower; but if we have never examined the hidden parts around which it circles and lovingly curls its dainty envelope, we must not be too hasty in expressing ourselves.




ORGANS OF THE FLOWER

cal—Calyx
cor—Corolla
st—Stamens
p—Pistils

It is true that the flowers were made to delight us with their beautiful colors and sweet fragrance; but the most important duty of the flower organs is to "yield seed." However beautiful the flower may be, if it perform not this duty, it is a disappointment and a failure.

The stamens contain in little saclike *anthers* the pollen dust, which the flower must have in order to make seed that will grow.

The pistil contains the *ovary*, or seed cradle, the vessel which holds the *ovules*, or undeveloped seeds. Above this seed cradle is the *style* which holds up the *stigma*. This stigma is the organ upon which must be placed the pollen grains. These pollen grains sprout, and send down through the style into the seed box a little root. The roots from the pollen grains pierce the little seedlike ovules, and they begin to grow; and it is by this growth that the true seeds are produced.

HUMMING BIRD GATHERING NECTAR

In order to produce the very best seeds possible, it is usually desirable for the pollen grains to be carried from one plant to another. By careful study it has been discovered that this transfer of pollen dust from flower to flower is largely the work of such insects as the bees, the butterflies, and the moths; and perhaps even the humming birds have something to do in this work of transfer. It is quite certain, too, that pollen is carried from flower to flower by the wind; for pollen of the dusty sort flies about in the slightest breeze, and there are many naked and feathery pistils that depend upon the wind for the grains of pollen dust which they need in order to ripen their seeds. If you were ever in a cornfield after the corn "tasseled," you could not fail to see the pale yellow dusty pollen which flew about when a cornstalk was



jostled. Much of this pollen dust is showered upon the corn silks, and finds its way down into the seed cradle below.

Does this study of the flower and its work suggest to you any lesson? The flower has a definite work to accomplish. Have not you also a definite work? The flower is in partnership with other workers, and is in a measure dependent upon their help. With whom do we work in partnership from day to day in order that success may be ours?

**Spell and define**

| | | | |
|---|---|---|---|
| se′ pal | pis′ til | co rol′ la | en′ vel ope |
| pet′ al | yield | o′ vules | stig′ ma |
| ca′ lyx | o′ va ry | pol′ len | style |

**Requirement**

Show by diagram the arrangement of the four circles or sets of organs which you find in any common flower.

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## Lesson LV

### *Kinds of Fruits*

**But the fruit of the Spirit is love, joy, peace, long-suffering, gentleness, goodness, faith, meekness, temperance: against such there is no law. Gal. 5: 22, 23.**

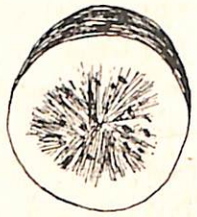
Did you ever observe a blossom change into fruit? Watch carefully the blossoms upon some tree or plant, and you will be able to tell what becomes of all the flower organs, and which parts of the flower really grow into the fruit.

We have previously learned that there are two great classes of fruits. The soft, pulpy, and juicy fruits belong to one class, and the hard and dry fruits to another class.

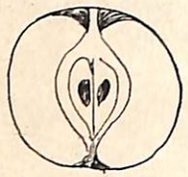
THE BERRY

To the *fleshy fruits* the following names have been given:—

1. The *berry*.— This fruit is very well known, and is a favorite everywhere. The tomato, the grape, and the currant are all berry fruits; for they grow after the plan of all berries, and have a rather thin skin.


PEPO — MELON

2. The *pepo*, or gourd fruit.— This fruit is a berry with a hard rind, but fleshy on the inside. The squash, the pumpkin, the melon, and the cucumber are all pepo fruits. In these fruits the hard outer rind is formed by the thickened calyx.


POME — APPLE

3. The *pome*.— The fleshy, eatable portion of this fruit is really a much thickened calyx. It surrounds a core which holds the seeds. The apple, pear, and quince are pome fruits. When we eat these fruits, we are really eating thickened calyxes of flowers.

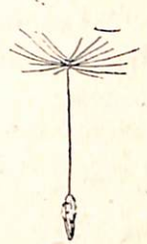
DRUPE — PEACH

4. The *drupe*, or stone fruit, is much like the berry except it contains a very hard portion, called the stone. This stone is the seed of the fruit. The peach and the cherry are familiar examples of this kind of fleshy fruit.

The dry fruits are a very large and important class. There are many more kinds of these than of fleshy fruits;



but not all kinds are used by man as food, and many of them are so seedlike in appearance that they are often mistaken for seeds.


ACHENE — DANDELION

GRAIN — WHEAT

1. The *achene*.— This is a small fruit with but one seed. The buttercup, the sunflower, the thistle, lettuce, and the dandelion, all produce achene fruits.

2. *Grain*.— This fruit also has but a single seed. Wheat, rye, oats, Indian corn, and all other kinds of grains, belong to one class. These are especially valuable to man as food, being called "the staff of life." Some kinds of grain are also much used as food for domestic animals.

GRAIN — OATS

LEGUME

3. The *nuts*.— These fruits are one-seeded, but are provided with a hard, bony wall. They also were created for food, and are widely used by both man and beast. There are many kinds, as the walnut, the hazelnut, the chestnut, the butternut, the almond, and the filbert. The name "nut" is commonly applied to many kinds of food that are not really nuts, but instead are legumes, and tuberous roots, and other forms of growth.

FRUIT OF CHESTNUT

A CONE — FRUIT OF PINE

4. The *legume*, or pod fruits.— Many of the pod fruits also are very valuable as food producers, among them being the peas, beans, and lentils. The locust also is a pod fruit.

5. The *cone*.— The fruit of the pine, the cypress, and the cedars is called a cone.

A CAPSULE— POPPY FRUIT

THE KEY— MAPLE

6. The *capsule*.— The fruit of the poppy, the morning-glory, and many other plants, is called a capsule. When ripe, the fruit sometimes splits open lengthwise.

7. The *key fruit*.— Some trees, like the elm, the ash, and the maple, produce a dry fruit furnished with a wing or a pair of wings.

There is another kind of fruit spoken of in the lesson heading text. What does this text mean, and why are these things called fruit? Do all persons bear this fruit? Jesus said, when teaching the people: "Ye shall know them by their fruits. Do men gather grapes of thorns, or figs of thistles? Even so every good tree bringeth forth good fruit; but a corrupt tree bringeth forth evil fruit. A good tree can not bring forth evil fruit, neither can a corrupt tree bring forth good fruit. Every tree that bringeth not forth good fruit is hewn down, and cast into the fire. Wherefore, by their fruits ye shall know them."

Spell and define according to their use in the lesson

ber′ ry
pe′ po
pome
drupe
a chene′
grain
cone
leg′ ume
cap′ sule



Note Book Requirements

1. On page 51 make similar sectional drawings of two other *pome* fruits besides the apple, and three sectional drawings of three different *drupe* fruits.
2. Under the illustrations on page 52, state to what class the fruits belong; and upon the right hand side of the page make sectional drawings of the same fruit.
3. On page 53 name the seven kinds of dry fruits described in the lesson, and give examples of each.

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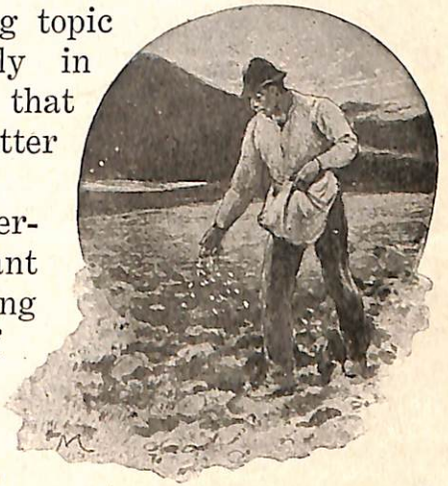
## Lesson LVI

### *The Scattering of Seeds*

**And He said, So is the kingdom of God, as if a man should cast seed into the ground; and should sleep, and rise night and day, and the seed should spring and grow up, he knoweth not how. Mark 4: 26, 27.**

This is a very interesting topic for study. It is generally in late summer and autumn that the fruits ripen and scatter their seeds.



THE SOWER

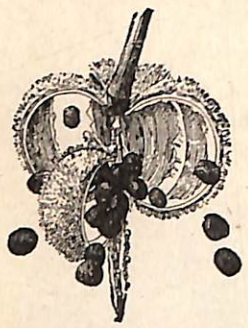
It is true that the scattering of seeds is very important in continuing and increasing the number of any kind of plant; and the parent plant has not finished its work until its seeds have been

ripened in such a way that provision has been made for their distribution.

The great majority of fleshy fruits are eatable by man or some of the lower animals. This fact makes certain the wide scattering of the seeds; for, if either too bitter or too hard to eat, they are thrown away.

Many dry fruits, such as the achenes of the thistle and the dandelion, and the key fruits of the maple and other trees, are of such a character that they are readily borne about by the breezes. Thus their seeds are sure to be scattered.

Some plants, called "tumble weeds," break off at the roots, and the whole plant goes rolling and tumbling along over the prairies until it is stopped by a fence or some other obstacle. These plants are said often to carry as many as two hundred thousand seeds.



EXPLODING SEED POD

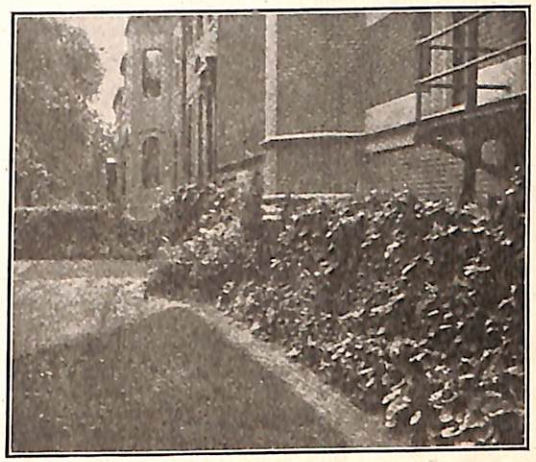
Many of the fruits, such as the capsules of the poppy and some of the pods of other plants, scatter their seeds by explosion. This is due to the unequal drying of the fruits, which causes them to warp. While in this condition, if the fruit is disturbed, it suddenly bursts and scatters the seed. When the ripened pod is touched ever so lightly, it gives a snap that sends the inclosed seeds several feet away.

Seeds that will not sink are often carried great distances on the water. The cocoanut fruit, with its light fibrous husk and waterproof shell, is an example of a



fruit that may be carried in this way. The achenes of sedges and pond lilies float upon the water like little air-filled boats. But if you look carefully, you will see, within, a tiny body which is really the seed.

Some seeds are provided with hooks and spines. These are often exceeding strong, and help the seeds to attach themselves to the bodies and clothing of animals. Cocklebburs can hardly be removed from the tails of horses and cattle in which they have become matted, without cutting out all the hairs to which the bur is fastened.



PLANTS NEAR A BUILDING

The work of cultivating these plants was done by children of six to nine years.

Seeds floating on the quiet surface of the water, may be carried on the feathers of some swimming bird from one pond to another. When a wading bird alights on the margin of a pond or lake where the mud is full of seeds of water plants, whatever seeds are in the mud that cling to it, will be carried away and left elsewhere.

**Questions**

1. At what time of year do we find most plants ready to scatter their seeds?
2. What seeds in your neighborhood are scattered by the wind?

3. With what plants are you familiar that scatter their seeds by explosion?
4. What seeds are likely to be scattered by the birds and animals near your home?
5. Are there any "beggar" seeds in your neighborhood? In what way do they succeed in getting from place to place?
6. Can you find the achenes of any plants floating upon the pond near your home?
7. Can you think of ways in which the seeds of very undesirable plants get passage from one continent to another?
8. To what seeds does the farmer wish to give a fair chance?
9. Of what is seed a symbol?
10. Mention agencies now constantly at work in scattering the "seeds of the kingdom."

**Requirement**

Make a collection of seeds for your school, and be able to describe the fruit in which each kind of seed ripened.

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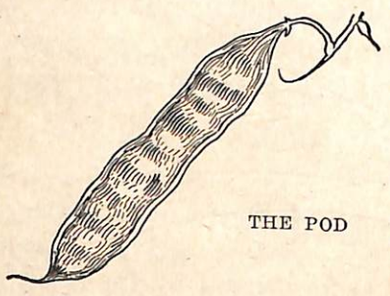
## Lesson LVII

*The Pod Family*

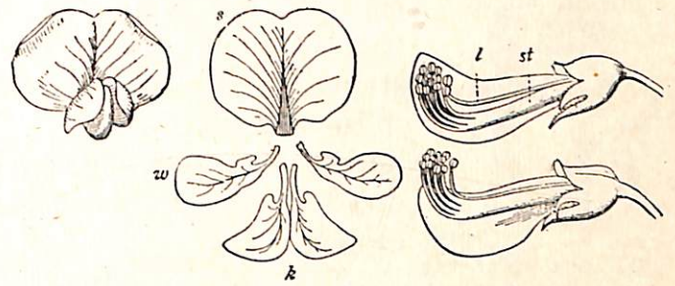
The rose family is famous for the great variety of fruits which it provides for man; but the pod family is deserving of a great deal of credit for the bountiful supply of good food which it furnishes. It is so named because the seeds are packed away in long, slender pouches, called *pods*.



THE POD



The plants of this family can be told by an examination of the flowers before they develop into the fruit. The flowers are *papilionaceous* in shape. In other words, the flowers of the pod family are thought to resemble a butterfly in appearance. Here is a picture of a sweet pea flower, which is so highly esteemed because of its beautiful colors and sweet fragrance. There are five petals in the corolla. Two of the petals form the rounded keel; two others, one on each side of the *keel*, form the *wings;* and the remaining petal, which stands out by itself, is called the *standard.* The flower has ten stamens, and a long, slender pistil, which contains the seed. This pistil develops into the pod. When the pod is ripe, it splits along one side, and the seeds drop out. Be sure to examine a pea or bean flower and locate all the organs mentioned. The most useful plants in the family are those which provide man with food that contains considerable starch. This is a very necessary element in the diet of man.




FLOWER OF SWEET PEA, SHOWING ORGANS

s. Standard w. Wings k. Keel l. Loose stamen st. Stamen tube

Between the common white bean and the large, cream-yellow lima bean, we have a great many kinds, varying in size, color, and flavor. Beans are a staple article of diet, and are very nourishing. The bean is the poor man's

friend, not only because it is nourishing, but also because it is a very inexpensive food.

The bean does not require a rich, fertile soil. It grows best in light, sandy soil. Land that will not grow beans is thought to be of little value.

Some bean plants grow erect or spreading, while others are vinelike, and have to be supported like the hop. String beans for cooking are prepared by pulling off from the pod the stringlike dorsal rib, which is similar to the midrib of a leaf. This part would not be palatable. Peas, both fresh and dried, make a very wholesome dish when cooked.

BEES ARE PARTNERS IN SEED MANUFACTURE

The cowpea, which is really a bean, is a native of eastern Asia, and is now cultivated in the southern part of the United States for cow feed.

Lentils are the round, flat seeds of a pod family plant which is cultivated in the countries bordering the Mediterranean Sea, and elsewhere. Lentils are of great value as a food.

The pod family furnishes abundant food for some of the lower animals, especially the cow, sheep, and horse. Besides the cowpea, there are the clovers — red, white, and alfalfa. All of these are hardy plants, and provide farmers with hay for the feeding of their stock. These clovers also furnish a large amount of the honey gathered by the industrious bees.

The pod family furnishes us with many plants bearing beautiful, sweet-scented flowers. The locust tree is one of the lovely flower producers. The lupine, vetch, and others, are all members of the pod family; but you will have no difficulty in acquainting yourself with them, and will be well repaid for all pains.



**Questions**

1. What plant family furnishes man with most of the fruit?
2. What family is considered in this lesson? Why is it so named?
3. How can a plant of this family be easily recognized?
4. Describe the organs of the sweet pea, its colors, and its fragrance.
5. Name the most useful plants in this family.
6. Name and describe different bean seeds. Why is the bean prized so much as food?
7. Describe the pea and cowpea.
8. Describe the lentil seeds. Where are they grown, and for what purpose?
9. What plants of this family provide food for the cow, sheep, and horse?
10. What plants of this family provide beautiful, fragrant flowers?

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## Lesson LVIII

### *Some Common Trees*

**The righteous shall flourish like the palm tree: he shall grow like a cedar in Lebanon. Those that be planted in the house of the Lord shall flourish in the courts of our God. Ps. 92:12, 13.**

Trees are the highest type of plant life. How could we get along without the trees! They seem the most human of anything in the plant creation. How lonely

and discontented we feel without our tree friends. They stand by the way, extending their arms of welcome, shaking their hands in gladness, and bowing respectfully to all who pass. Do we acknowledge them in return by seeking their acquaintance, and doing what we can to protect them from all harm? Or do we ruthlessly gash their trunks, break their limbs, and treat them as though they had no right to exist?

MARIPOSA BIG TREE, CALIFORNIA

A stage line has been cut through this tree.

You probably are acquainted with some of the trees, as the oak, maple, and fir; but let us become close observers of all the trees in our neighborhood, so that we can know of their habits of life.

The common elm is probably a native of England, but it is found throughout the greater part of Europe, in North Africa, in Asia Minor, and as far east as Japan. It grows best on rich, moist land, and reaches a height ranging from sixty to one hundred feet, and sometimes even higher. Its branches are many and spreading, and often drooping at the ends. The bark is rugged, flaky, and tight fitting, except that of the slippery elm, which peels very readily.

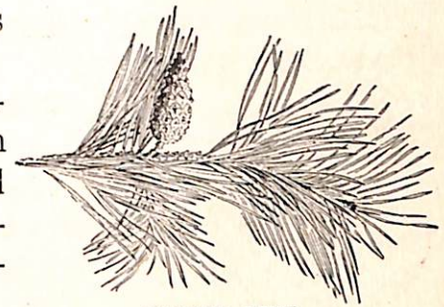
The timber of the elm is very tough and durable if not exposed to both wet and dry weather. It is used for carriage building and ship building. It is very durable



under water, and for this reason it is used for piles and wharves.

But it is most appreciated as a shade tree, because of its wide, branching limbs and dense foliage.

The flowers are of a greenish color, and are arranged in umbels or racemes. The seed is surrounded by a thin, circular wing which aids in scattering it.



SCOTCH PINE

One quarter natural size

The leaves are ovate, double serrate, and pinnately netted-veined. They are quite rough and usually uneven at the base. The old white elm that stood on the Boston Commons is supposed to have been in existence before the city. It was blown down in 1876. The trunk measured twenty-two feet in circumference.

While you are observing the trees, do not fail to form an acquaintance with those which are a good example to us of a constant, unchanging character. Whether winter or summer, rain or sunshine, they seem to say to us, "Keep on growing, your green foliage showing."

CONE AND TWIG OF BLACK SPRUCE

One quarter natural size

These evergreen trees do shed their leaves; but while some are fading and falling, others are growing to take their places.

These trees are very valuable to man, not only for

ornament, but to provide timber for house and ship building. The sap from these trees produces tar, turpentine, and resin.

The most common evergreens are the pines, spruces, firs, hemlocks, and arbor vitæ. Can you tell one from the other? You should know these trees well enough to do that, and later study their leaves, flowers, and fruit.

SPRAY OF HEMLOCK
One third natural size

The pines have their leaves wrapped together in groups of from two to five. The cones are thick and woody. At the base of the leaves are some thin, dry, hard scales. There are many varieties of pine.

The leaves of the spruce trees are quite different from those of the pine. Instead of being in clusters, they are single, and without a sheath at the base. The leaves are about one inch long, with short petioles. The spruce likes a cold climate, and grows in many sections of northern United States and Canada. It also grows on mountains farther south.

THE ARBOR VITAE
Nearly one quarter natural size

The leaves of the balsam fir are arranged much the same as those of the spruce; but they differ in shape. The under side of the leaves is of a silvery color, while the upper side is green. Firs grow naturally in the cold, damp grounds of northern United States and Canada.

The hemlock leaves are single, like those of the spruce, but flat, with rounded point, and are about half an inch



long. They are green on the surface, and whitish beneath. A hemlock twig is an interesting object. There is a pleasing arrangement of leaves upon the gracefully drooping branches. The leaves appear to be borne in two rows, more or less regular, one on each side of the branch or twig. This tree is much used for lumber.

CONE OF WHITE PINE
One quarter natural size

The arbor vitæ leaves are very small and scalelike, and overlap each other. One might wonder at first if it has any leaves at all. They are arranged in four rows on each branch.

The arbor vitæ is much planted for hedges and screens, as well as for other ornamental purposes. The tree is abundant in a wild state in New York.

With the above description, you will be able to tell these classes of evergreen trees by their leaves; and later you will want to learn to recognize the different kinds of pine and spruce when you see them.

**Questions**

1. What is the highest type of plant life? Compare man with a tree.
2. Give scriptures that represent man by a tree.
3. Describe the elm tree. Where does it grow? For what is its lumber valuable?
4. What trees represent a constant, unchanging character? Why?
5. Do the evergreen trees shed their leaves? If so, when and how?
6. For what are these trees valuable?
7. Describe the leaves of the pines; the spruces.

8. Describe the leaves of the hemlock, fir, and arbor vitæ.
9. What kind of tree did David say he was like? Ps. 52: 8.

**Note Book Requirement**

On pages 55 and 56 write a story about the trees of your neighborhood.

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## Lesson LIX

*Plants with No Flowers*

The plants we have studied thus far all bear flowers; but there are a great many plants which do not bear flowers. We shall not study these fully now, but will speak of a few of them so that you may recognize them when you see them. The flowerless plants greatly outnumber those which bear flowers. You will be surprised at learning where some of them grow, and how very small they are.

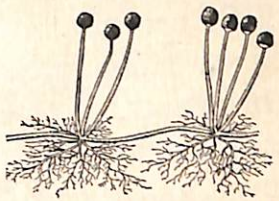
TOADSTOOLS

On the bottom of a watering trough, and at the sides, you will see g r e e n, slimy-looking material, which is called *oscillaria*, because it oscillates, or swings to and fro, in the water. With the oscillaria we often find clusters of green, berrylike bodies, and also another kind of plant that looks much like a string of beads.



The green slime which you see on stagnant water, called "pond scum," is another beautiful flowerless plant. Mingled with the pond scum we find beautiful boat-shaped and crescent-shaped bodies. All these are simple little flowerless plants that live in the water. To the ordinary observer, they may seem uninteresting; but if you will take a little of the scum and place it under a compound microscope, it presents a most beautiful scene. Swimming around among these microscopic plants, may often be seen myriads of microscopic animals that feed upon the plants.

Many of the dreaded germs which cause so much sickness, are exceedingly small plants which get into our bodies with the impure water and air. Such diseases as diphtheria, smallpox, scarlet fever, and typhoid fever, are caused by tiny germ plants. Mold, or mildew, is another flowerless plant, which grows in damp places. When greatly magnified, it looks like this.


MOLD — FLOWERLESS PLANT

Mushrooms and toadstools also are flowerless plants. Like many others, they thrive on decaying matter. They often shoot up in a single night, and require only a few days for growth. When fully ripe, little brown seedlike bodies, called *spores*, drop from the plant to the ground. These spores take the place of the seeds of other plants, and produce fine white cords called *spawn*. This spawn spreads over the soil, drawing up water and nourishment; and from the spawn new mushrooms grow.

Many mushrooms are poisonous, so that we should

not gather them without knowing something about them. One poisonous mushroom has a cap which turns into a black fluid when ripe. Another kind grows very large with its cap full of dust. This dust is made up of tiny spores; and when crushed, the spores fly out in all directions. It is called the puffball mushroom. There is a certain kind of mushroom that grows on trees. It pushes its tiny threadlike spawn into the growing tree, and sucks up its nourishment.

The mosses and ferns are higher members of the flowerless plants. They are found growing in the woods where the soil is rich and shaded. They also bear tiny grainlike *spores* instead of seeds. These spores can be found in little brown cases along the edges of the *fronds*, or sometimes running lengthwise down the center of the leaflets. In mosses, the spores are borne aloft in little capsules on the tops of long leafy stems. When ripe the capsule bends over and upsets the spores. These fall upon the damp ground, and begin to take in food.

The tiny mosses have many uses. They appear before the blossoms, and they remain long after the summer flowers have gone. They furnish the birds with soft leaves for nest building, and with ripened spores for food. They make storehouses for wandering insects; and they make rich mold, keeping the soil moist around the roots of ferns and bushes.

The ferns are graceful plants, with fronds of delicate green. They grow all the world over, and are everywhere considered our most beautiful plants for decoration. Some



ferns bear flowers, thus connecting the flowerless plants with those which bear flowers.

**Spell and define**

| | | |
|---|---|---|
| flow′ er less | os′ cil late | slime |
| os′ cil la′ ri a | clus′ ter | scum |
| mi cro scop′ ic | myr′ i ads | spore |
| diph the′ ri a | ty′ phoid | mold |
| cap′ sule | frond | spawn |

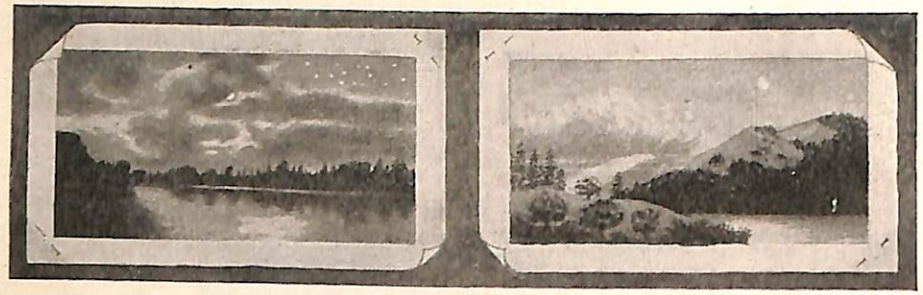
**Note Book Requirement**

On page 57 write a story entitled "Plants with No Flowers."

## CHAPTER VII

# SUN, MOON, AND STARS

*(Scripture Basis, Gen. 1:14-19)*



*"And God said, Let there be lights in the firmament."*

## Lesson LX

### *The Starry Heavens*

**Lift up your eyes on high, and behold who hath created these things, that bringeth out their host by number: He calleth them all by names by the greatness of His might, for that He is strong in power; not one faileth. Isa. 40:26.**

Lessons of the Creator's love, His wisdom, His power, are as truly written in the broad starry heavens above us, as upon the tiny starry flowers which we have been examining at our feet. In whatever part of the world we may be, God's great starry lesson book shines out invitingly overhead; and the blessed word of God urges us to



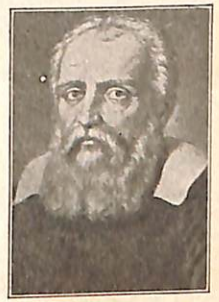
 Thursday

lift up our eyes on high, and behold Him who has created these things.

The earth on which we live is, in fact, surrounded by stars on all sides. This fact was well understood anciently, even by those who had lost the knowledge of the Creator and His relation to these light and heat givers, and worshiped these created bodies of light instead of their Maker. These men pictured the earth as standing in the center of a hollow crystal sphere, in which the stars were fixed like golden nails. Some of these people spent much time in observing the relation of the heavenly bodies to each other, and trying to account for their various movements.

COPERNICUS

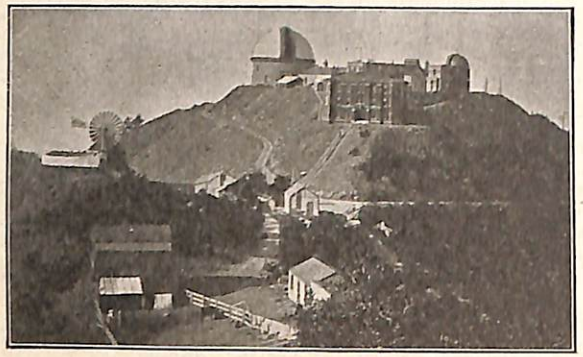
Ptolemy, an Egyptian astronomer, who lived in the second century after Christ, believed that the earth occupied the center of a system of immense, hollow, transparent spheres, placed one within another; and that the sun, moon, planets, and all the stars occupied fixed positions in these separate crystal spheres. He thought that these, turning once every twenty-four hours around our earth, accounted for the succession of day and night and for the changes which he could see in the positions of the various heavenly bodies.



GALILEO

It was not until about four hundred years ago, near the close of the period known as the "Dark Ages," that

people began to believe the teachings of *Copernicus* and others who thought (1) that the earth is round; (2) that it turns upon its axis from west to east; and (3) that the earth and other planets revolve around the sun. Next the great Italian scholar *Galileo*, who first used the telescope, began to make important discoveries, which have since that time been carried still further, until now many wonderful things concerning the starry heavens are known with considerable certainty.



AN OBSERVATORY

To begin with, the *stars*, so far from being fixed in a hollow glass globe, are all in rapid motion, and their distances vary enormously; although all of them are so very far away that they appear to be at rest, as does a ship when sailing along at a great distance from us. It is that power that "never faileth" that guides and upholds the countless hosts with which the sky is spangled in a cloudless night.

Men have learned, by using the telescope, that all the starry hosts which are visible to the naked eye, are but a cluster of islands, as it were, in a boundless ocean of space. It has been said that we may think of the stars which we see as forming *our universe;* and when we have this thought well fixed in mind, we may think of space as



being peopled with *other universes*, just as there are other cities besides New York in the United States.

The largest telescopes that we have will show perhaps a hundred million stars. The brightest stars are nearest to us, and the faint ones are very far away — indeed, inconceivably far. If it were possible to use larger and better telescopes than man has ever yet been able to construct, we doubtless would find countless stars which are as yet out of vision.

**Questions**

1. What invitation to study the stars is given in God's revealed word?
2. Describe the appearance of the sky at night.
3. In the daytime, what do we behold in the sky?
4. What becomes of the stars in the daytime?
5. Why did many of the ancients worship the heavenly bodies instead of their Maker?
6. How did these men picture the earth?
7. What did Ptolemy teach about the heavenly bodies?
8. State the teaching of Copernicus.
9. Who was Galileo, and what did he do?

**Spell and pronounce**

| | | | |
|---|---|---|---|
| Co per′ ni cus | suc ces′ sion | spheres | an′ cients |
| trans par′ ent | E gyp′ tian | Gal i le′ o | crys′ tal |
| as tron′ o mer | Ptol′ e my | tel′ e scope | u′ ni verse |

**Note Book Requirement**

On page 58 write some texts of Scripture which teach that God is the Creator of the starry heavens, and that they declare His power and glory.

# Lesson LXI

## *Holding and Upholding Power*

**He is before all things, and by Him all things consist. Col. 1:17.**

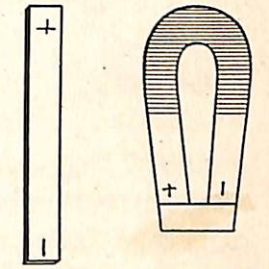
A power that never fails keeps the sun, the moon, and all the stars moving in their paths through trackless space, without disorder or confusion. What is this power, and to whom does it belong? From eternity there has been a power at work that not only *holds* the particles of the earth together, and the objects upon the earth; but also *upholds*, or holds bodies above the earth.

Every one has noticed the results of this power at work about and above us; but Sir Isaac Newton, one day sitting in an orchard, observed an apple fall to the ground, and began studying this strange, mysterious power, everywhere working so quietly and yet so powerfully. He thought and thought over this problem for sixteen long years, bringing all the mathematics he could command to his aid, and, at the end of that time, solved the problem, announcing to the world the *universal law of gravitation.* He called this power *gravity*, and said that it acted on all the heavenly bodies throughout the universe. Now, who is the author of all this power? David, a great student of nature, says, "God hath spoken once; twice have I heard this; that power belongeth unto God." Paul uses expressions like these: "Upholding all things by the word of *His* power;" "By *Him* all things consist," that is, hold together. Christ is the one referred to in the above expressions. Thus we learn from the Bible that this mysterious *holding* and *upholding* power



belongs to God; for all power is from Him. God manifests His power in many different ways, a few of which we shall study in this lesson.

1. *Cohesion.*— The power that holds *like* particles together is called cohesion. All objects composed of one substance are held together by this cohesion. How difficult it is to break the stones and rocks into fragments!




STRAIGHT MAGNET — HORSESHOE MAGNET

2. *Adhesion.*— The power that holds *unlike* particles together is called adhesion. This is illustrated by glue and wood, and various cements that are used for mending broken china and glassware. This power called adhesion is sometimes stronger than cohesion; for a mended dish on a second fall will often break in a new place more easily than where it was mended.

BIGGEST LIFTING MAGNET IN THE WORLD

This magnet is 60 inches in diameter and will handle balls weighing 50,000 pounds.

3. *Magnetism.*— This mysterious power is capable of attracting through the magnet, separated objects, as pins, tacks, and other fragments of iron and steel. It is the best illustration we have of the power of gravitation, and a few simple experiments will serve to make it plain.

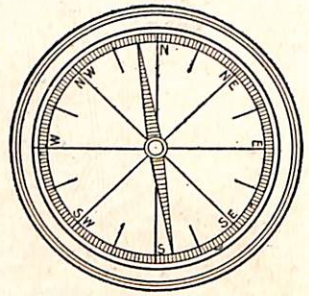
In Magnesia, a district of Greece, an iron ore was found that attracts to itself tacks, and needles, and small bits of iron, when brought near them. The common name of this iron ore is "lodestone"; but the name "magnet" comes from the name of the place, Magnesia. Secure, if possible, a piece of this magnetic ore, and test its attractive power. If you can not secure it, obtain a toy magnet from a store. There are two kinds, the straight and the horseshoe magnets. The latter is stronger, because both ends, or *poles*, can be used in lifting an object. The bar uniting the poles is called the *armature*. The strength of the magnet is retained or even increased by keeping the armature in place.

LODESTONE

**Experiments**

1. Dip the bar (straight) magnet in iron filings and then shake it. Do the filings adhere to the entire surface of the magnet?

2. Place the filings on a pane of glass, and the magnet under the glass beneath the filings. Tap the glass and notice how the filings arrange themselves at the poles, or the two ends, of the magnet.




MARINER'S COMPASS

3. Magnetize a needle by drawing the magnet across it in one direction, and then suspend it horizontally by means of a thread. Bring the bar near one end of the needle; now near the other. What takes place? Will magnetism act through glass, paper, and wood? Try it by placing them between the needle and the bar.

The end of the needle pointing north, or nearly so, is called the *positive pole* of the needle magnet. The other end is called



the *negative pole*. The same end always points northward, and this invariable law of action has resulted in the invention of the compass, so valuable to the mariner and the explorer.

Here we have a *dip needle magnet*. This magnet moves up and down instead of sidewise. If you will take a bar magnet and slide the dip needle over its surface, you will find that the needle rests in a horizontal position when at the center of the magnet; but when pushed toward the positive pole, it begins to dip, until, when the end of the magnet is reached, it points directly downward. This needle would point directly downward if it were over either of the magnetic poles of the earth.

DIP MAGNETIC NEEDLE

From these experiments you see that our earth is very much like a magnet, drawing to itself the objects that are upon it. No one has ascended so high in a balloon, no object has ever been thrown so high, as not to feel this drawing power toward the great magnet — our earth. Even the moon, two hundred forty thousand miles away, is influenced by this power. But on and on are other worlds and suns, influenced by this power probably radiating from other centers, until we come to the center of all centers — heaven, the habitation of God and the place of His throne. All the starry hosts encircle the throne of the Deity; and truly He upholds all things by the word of His power, and by Him all things hold together.

**Spell and define**

| | | | |
|---|---|---|---|
| grav′ i ty | ad he′ sion | lode′ stone | ar′ ma ture |
| co he′ sion | mag′ net | Mag ne′ si a | com′ pass |
| ra′ di at ing | in′ flu ence | neg′ a tive | pos′ i tive |

**Questions**

1. What about and above us proves that there is a power continually at work?
2. Who gave careful and long study to the working of this power?
3. How long did he study it? and what did he call it?

4. To whom does all power belong? Ps. 62:11.
5. In what three ways is God's holding power manifested?
6. Describe cohesion, adhesion, and magnetism.
7. What is the natural magnet called?
8. How are artificial magnets produced?
9. Which is stronger, the straight or the horseshoe magnet? Why?
10. From the three experiments given, what do you learn about magnetism?
11. Describe the horizontal and the dip magnetic needle. Describe the mariner's compass.
12. Compare gravity with magnetism.

Note Book Requirement

On pages 59 and 60 briefly describe the illustrations given.

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## Lesson LXII

### *A Trip to the Sun*

His face did shine as the sun. Matt. 17: 2.

The sun is the center around which not only our earth, but also seven other planets travel.

We have learned that the earth has a diameter of nearly 8,000 miles, and a circumference of 25,000 miles. We have learned that the earth has two motions. It turns on its axis every twenty-four hours, making its day; and travels about the sun every three hundred sixty-five days, making its year. We have learned many other things, also, concerning the earth upon which we live; but let us now take an imaginary trip away from the earth, and see



what we can learn. Let us start on our journey in the time of the new moon. At this time, we shall find the moon almost directly in the path of a straight journey to the sun. We travel 240,000 miles, which would be about ten times the distance around the earth, before we reach the moon. The moon has a diameter of more than 2,000 miles. It seems to be uninhabited, having no atmosphere, and created only for the purpose of reflecting to the earth the light and heat it receives from the sun. The moon travels about the earth in twenty-nine and a half days. The journey of the moon about the earth gives to us the month. It turns on its axis but once during this time, so that its day and month are of the same length.

But we must not stop longer at the moon station. On we go, and after a ride, not of thousands but of millions of miles, we come to the planet *Venus*. It is 26,000,000 miles from the earth. Think of it! No station between the moon and Venus — a distance of 26,000,000 miles, a little over one hundred times as great as the distance from the earth to the moon.

On taking the measurements of Venus, we find that this planet has a

THE SOLAR SYSTEM

Showing comparative distances in millions of miles.

diameter of 7,700 miles, just about the same as our earth. Its year is two hundred twenty-five of our days in length. Its day is the same as its year; for, strange to say, it appears to turn but once on its axis in making the entire journey around the sun. No moon has yet been discovered belonging to Venus.

We leave for the next planet, which is *Mercury*. We reach it after a long ride of 31,000,000 miles. Now we are 57,000,000 miles from the earth, or over two hundred times the distance of the moon from us. Still the sun is far, far beyond us. But in our amazement and wonder over the great distance we have traveled, let us not forget to take notice of Mercury; for it is the last planet we stop at before reaching the sun. This planet has a diameter of about 3,000 miles, or nearly half that of the earth. Its year is eighty-eight of our days in length. Like Venus, Mercury is moonless.

On again we go with no stop until we reach the sun. After a long ride of 36,000,000 miles, at last we reach our destination, the brilliant orb of light which is the center of the solar system. It is an exceedingly large body, having a diameter of 870,000 miles.

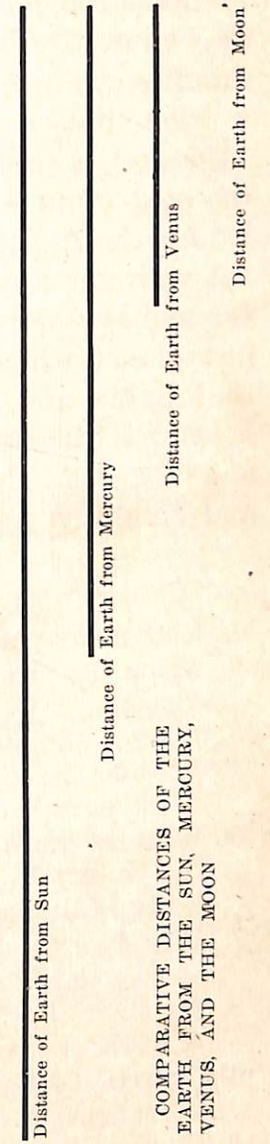
How long a journey have we taken in going from the earth to the sun? This we can find out by adding the distances between the stations. There were but three stations. The first was a suburban station just outside the earth, the moon, 240,000 miles distant. The second was the planet station Venus, 26,000,000 miles from the moon. The third was the planet station Mercury, 31,000,000 miles from Venus. And then we came to the great



sun, the central station, 36,000,000 miles from Mercury. The whole distance covered on the trip was nearly four hundred times the moon's distance from the earth.

It is impossible to comprehend this vast distance, but some idea can be gained by a few comparisons with things with which we are familiar. If we could have taken this journey by train, traveling at the rate of one thousand miles a day, it would have taken two hundred forty days, or eight months, to go to the moon; seventy years (counting three hundred sixty days to the year) to Venus; more than one hundred fifty years to Mercury; and more than two hundred fifty years to the sun. If this journey were to be completed during this present year, it would have had to begin only a few years after the Pilgrim Fathers landed in this country at Plymouth Rock, Mass., in the year 1620.

Now, let us return to the earth, going back with the light. Do you know how fast we will have to travel to keep up with the light? It will be very, very fast — 186,000 miles a second, which would mean to go around the earth eight times in a single second. Here we go, and in three minutes we have reached




COMPARATIVE DISTANCES OF THE EARTH FROM THE SUN, MERCURY, VENUS, AND THE MOON

Mercury, 36,000,000 miles from the sun; in six, we are at Venus, 67,000,000 miles from the sun; and in eight minutes, we are back to earth again, our starting point.

Sound does not travel nearly so fast as light, only 1190 feet a second. If a loud explosion had taken place the next minute after we left the sun, we would not hear it until fourteen years after reaching earth. But we shall not wait for anything, but prepare as quickly as possible for another journey, a trip away from the sun, out to the last planet which is lighted and heated by the same sun that lights and heats our earth. This glorious light of heaven is the best and truest representation of the light and glory that shine forth from the Sun of Righteousness and enlighten and warm the hearts of all mankind.

**Questions**

1. How many planets are there in the solar system?
2. Name the planet on which we live, and the two nearest the sun.
3. What is the diameter of the earth?
4. How do the diameters of Venus and Mercury compare with the earth's diameter?
5. What is the distance of Venus from the earth? Mercury? The sun?
6. What is the length of our day? Our year?
7. How does the length of the year of both Venus and Mercury compare with our day and year?
8. Which of the three planets have no moons? What is the distance to our moon?
9. Give the diameter of the moon, and the length of its day and month.
10. What is the diameter of the sun?



11. How far is Mercury from the sun? Venus? The earth?
12. What time would be required for a train to travel the distance from the earth to the moon? To Venus? To Mercury? To the sun?
13. How far does light travel in a second? Sound?
14. How long does it take for the sun's light to travel to Mercury? Venus? Earth?
15. How long would it take for sound to travel from the sun to the same planets?
16. Of what should the sun's light and glory be a continual reminder?

**Note Book Requirement**

Start a diagram of the solar system on page 61 by placing the sun at the center of the page and the planets one half inch apart from each other. Draw their orbits, and indicate the time required for each planet to make its journey about the sun.

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## Lesson LXIII

### *A Trip Away from the Sun*

**It is He that buildeth His stories [spheres] in the heaven. Amos 9: 6.**

The memory of the knowledge gained on our trip to the sun, makes us eager to start at once on our trip away from the sun. Let us not take this trip on slow transportation lines; for the journey is much longer than the previous one. Electric or steam car service would require over 7,000 years just one way. Even sound speed is too slow; for near 500 years would be required for the going trip. The speed we want is that which we may secure on the wings of light.

Now we are off, leaving behind us the earth with its moon, Venus, Mercury, and the sun. In five minutes we travel 48,000,000 miles, and arrive at the planet Mars. It is 141,000,000 miles from the sun. Instead of having one moon, it has two very small ones. The diameter of Mars is only a little over one half of that of our earth. Its day is thought to be the same as ours in length, but its year is six hundred eighty-seven of our days — nearly twice as long as our year.

We resume our journey, and pass through a swarm of about five hundred very small planets called *asteroids*. In thirty minutes after leaving Mars, we come to a huge planet called Jupiter. In this brief time we have traveled 342,000,000 miles. Jupiter has a diameter of 86,500 miles, and is 483,000,000 miles from the sun. How the distances between the stations increase as we go farther away from the sun! Jupiter has four large moons and four small ones. While this planet is so very large, yet it turns on its axis very rapidly, its day being but ten hours long. It takes twelve of our years for it to make its journey around the sun.

But now it is time for us to reach another planet. Here we have been on the way thirty-five minutes, and covered a distance of 403,000,000 miles, and now we come to a planet that is surrounded with beautiful rings, which are made up of a swarm of little moons. But it has in addition ten large moons. The name of this planet is Saturn. It is 886,000,000 miles away from the sun, and has a diameter of 73,000 miles. Its day is ten of our hours in length, while its year is thirty of our years.



Passing on in our journey for one hour and twenty minutes we come to another planet. Since leaving Saturn, we have traveled through 894,000,000 miles of space. This brings us to the planet Uranus, which is so far away that with the naked eye it can scarcely be seen from our earth. It is 1,780,000,000 miles distant from the sun, and has a diameter of 31,900 miles. Its day is ten hours, and its year eighty-four times as long as ours. On this planet but few human beings would live to be over a year old. Uranus has four moons.

One more ride and we are at our journey's end. It will take us one hour and a half to reach Neptune, the last planet, which is more than one whole billion or ten hundred millions of miles from Uranus. It is 2,790,000,000 miles from the center of the solar system, or about thirty times the earth's distance from the sun. It is 32,000 miles in diameter, but because of its great distance it can not be seen without the aid of a telescope. The length of its day is not known, but the length of its year is one hundred sixty-five of our years, almost twice that of Uranus. So to live a half year on Neptune would be to live to a good, ripe old age. Neptune has one moon, about the size of our own.

Now we are at the end of our journey; but we have passed only halfway through the solar system; for the planets, in their journey around the sun, must pass around to the opposite side. Let us now return to the sun, without any stops, and at the same rate of speed as the going trip. It requires more than four hours to reach the sun — a distance of 2,791,000,000 miles. As we have gone only

from one side of the system to its center, the whole distance across will be twice 2,791,000,000 miles, or 5,582,000,000 miles, and the whole time necessary to make the trip across, even at the rapid rate at which light travels, is over eight hours.

When God made our planet, "He created it not in vain, He formed it to be inhabited." So, no doubt, the other planets are also inhabited by intelligent beings.

You should observe the visible planets, especially Venus and Jupiter, as they are brilliant morning and evening stars. By consulting an almanac you can learn the best time for observing them.

These eight planets, accompanied by their twenty-six moons, form a grand procession, continuously marching about the sun.

Not only do the planets travel about the sun, but the moons go around the sun also. The sun is the center for the planets, and the planets are the centers for their moons. Here we have several small planet families making up the one great sun family.

But the sun does not stand still. The sun, with its planets and their moons, goes with other suns and their planets and moons about a larger sun, which is the center of attraction. Now think of this last great sun with all its attendants going with other suns and all their attendants around some still greater sun as a center, and so on until we come to the center of the universe. This is the wonderful machinery of heaven, wheels within wheels, set into motion by Him who does great things "which we can not comprehend."



**Questions**

1. Name the planets between Mars and the sun.
2. How long does it take the light of the sun to reach each?
3. What is the distance of each of these planets from the sun?
4. Which of the planets have moons? How many does each have?
5. Which planet has rings?
6. What are asteroids? Where are they found?
7. What is the distance across the solar system? and how long does it take light to travel through it?
8. Which of the planets appear as bright stars? Which as dim or invisible stars?
9. Explain the movements of the heavenly bodies as far as you understand them.
10. Can we fathom God's workings? Job 37:5.
11. Why is Jesus called the bright and morning Star?
12. Why is He called the Sun?

**Note Book Requirement**

On page 61 complete the diagram of the solar system and indicate the distance of each planet from the sun.

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## Lesson LXIV

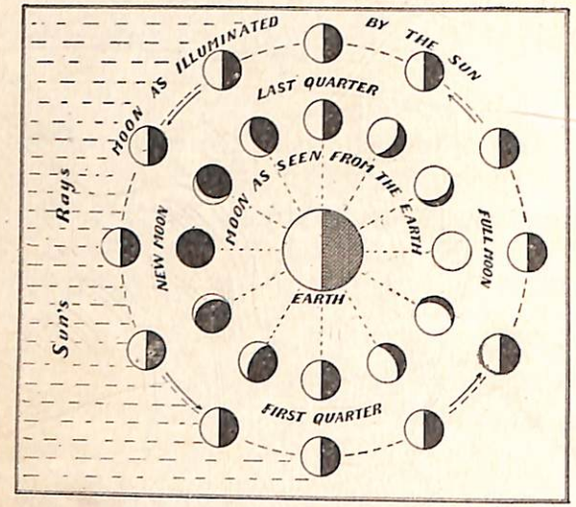
### *The Moon and Its Phases*

**He appointed the moon for seasons. Ps. 104:19.**

In previous lessons, we have learned some things about the moon; but one very interesting thing that we have not yet studied is the *phases* (faces) of the moon. Its face seems to be constantly undergoing changes, and you probably have wondered what causes these changes.

The accompanying diagram shows why the moon's disk changes as it passes around the earth. The sun

shines from a great distance on the moon, lighting up one half the surface of the earth and one half the surface of the moon. In the outer circle is the moon in different positions with one half of its face always lighted.




THE PHASES OF THE MOON

To one standing on the earth, the bright side will gradually disappear until only the dark side will be seen by the observer. Then the whole face of the moon will gradually be lighted up again. The inner circle of moons represents the gradual changes from a light to a dark face, and from a dark face to a light one.

The dark face at the left of the picture shows the new moon as seen just after sunset, nearly in the west. You see the moon is almost on a straight line between the earth and the sun, so the shaded or dark side is toward the earth. Only a thin crescent of light appears on its rim. This phase is called *new moon*. As the moon passes on, more of its lighted surface appears; and when it is one quarter of the way around, its phase is called *first quarter*. When the moon is half way around the earth in its orbit, then its full lighted face is seen, and it is called *full moon*. This phase of the moon appears in the east



just after sunset. The earth is then nearly on a direct line between the sun and the moon, instead of the moon's being between the earth and the sun, as during the new moon.

As the moon passes on, it begins to hide its lighted face; and when three fourths of the way around, it is called *last quarter*. Gradually the lighted face disappears altogether, and the new moon phase repeats itself.

You can demonstrate this lesson in a very simple way. Remove one half the covering from an orange. Place a lighted lamp in one corner of a dark room, and let it represent the sun. Standing as far away from the lamp as you can, let your head represent the earth, and the orange held at arm's length the moon. The white or peeled surface of the orange should be toward the lamp. Now move the orange slowly around to the left, keeping the peeled face always squarely facing the lamp. Keep the eye constantly on the white surface of the orange as you turn around, and you will see the changes representing the different phases of the moon. It will be new moon when the orange is between your head and the lamp; first quarter, when it is at your left; full moon, when it is directly on the opposite side of your head from the lamp; and last quarter, when it is at your right.

The moon as well as the sun has something to do with the seasons. Some people watch the moon very closely, and do their sowing and planting during certain phases, believing that this insures a better harvest. Just how far this is a superstitious notion we do not know. Possibly the moon has more to do in helping to produce

crops than we have ever thought. The sun does not do all the work. The moon does the night work, while the sun works during the day. Read Deut. 33:14, and see if the moon does not work as well as the sun in helping to bring forth our bountiful harvests.

**Questions**

1. How far is the moon from the earth?
2. What is its diameter?
3. What is meant by the expression, "phases of the moon"?
4. Name the four principal phases, and tell how they are produced.
5. What is the present phase of the moon?
6. What is the relation of the moon to the sun?
7. Does the moon exert an influence on vegetation?
8. Does the moon shine by light of its own, or by reflected light?
9. In what way does the moon represent God's people?

**Note Book Requirement**

Place a diagram of the phases of the moon on page 63.

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## Lesson LXV

*The Seasons*

**Thou hast made summer and winter. Ps. 74:17.**

When God ordained the sun and moon for their work on the fourth day of the creation week, He said, "Let them be for signs, and for seasons, and for days, and for years."



Here we have a diagram showing the cause of the seasons. The sun can shine upon only one half of a sphere at one time. This you can illustrate by holding a ball at night before a lighted lamp. Now the earth has

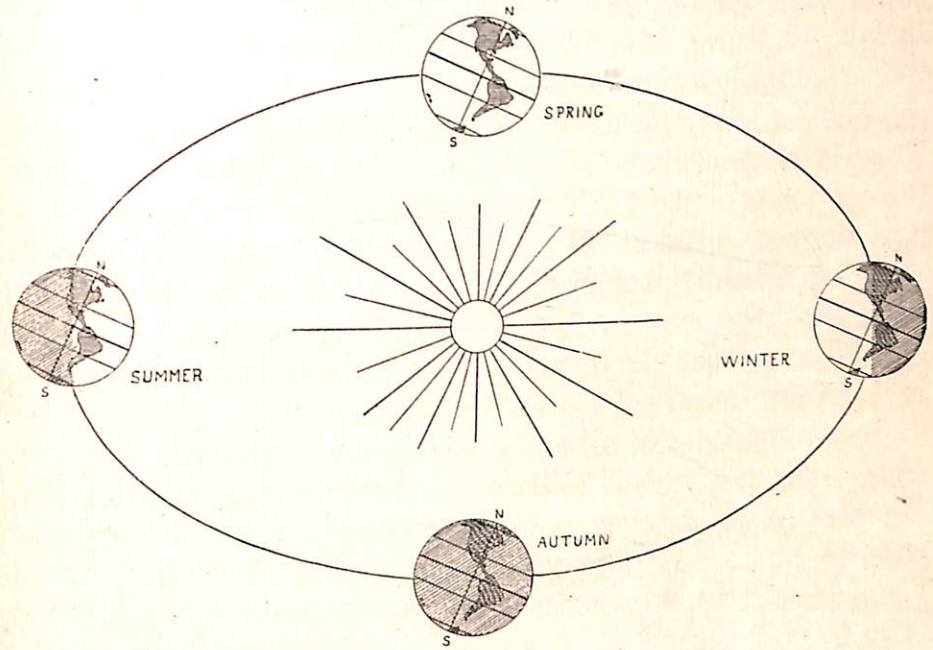



DIAGRAM OF THE SEASONS

a path about the sun, called its *orbit*. As the earth makes its journey in this orbit, one half of its surface is continually lighted by the sun.

Let us follow the earth about the sun. We will begin with the earth as we see it at the right of the sun in the diagram, and marked "Winter." This is the winter position for those living in the Northern Hemisphere. Notice that the axis of the earth is tipped to one side.

In other words, the earth is inclined so that the light of the sun does not reach the North Pole, but it shines beyond the South Pole. The light goes twenty-three and a half degrees beyond the South Pole, and comes just that much short of reaching the North Pole. It is *winter* for all living north of the Equator, and *summer* for all those living south of the Equator.

Now notice the earth on the opposite side of the sun. This is the position it reaches in June. We have just the opposite here. The sun shines twenty-three and a half degrees beyond the North Pole, and comes that much short of reaching the South Pole. Where there is no light, or where the rays strike slantingly, there is not much heat. So we have summer in the Northern Hemisphere, and winter in the Southern Hemisphere.

Now let us examine the earth just half way between these two positions. When we look at the position the earth occupies in September, we see the sun shining from pole to pole. At this point the days and nights are of equal length on the earth at any given place. It is neither winter nor summer. It is fall, or more properly speaking *autumn*, in the Northern Hemisphere.

Next look at the earth just opposite the autumn position. Here, too, you see the sun shines from pole to pole, and the days and nights are equal in length. It is *spring* for all north of the Equator.

The winter position of the earth in its orbit is called the *winter solstice*. The summer position is called the *summer solstice*. The shortest day, December 21, opens the winter, and the longest day, June 21, begins the summer.



The autumn position is called the *autumnal equinox*. The spring position is called the spring or *vernal equinox*. The word "equinox" means "equal nights." You remember that September 21 marks the beginning of autumn, and March 21 the beginning of spring. On these two dates the days and the nights are of equal length.

On account of the axis of the earth being inclined twenty-three and a half degrees, the days keep varying in length. If the earth's axis were not inclined, but were perpendicular, then the days would always be of equal length. Then, too, there would be no change of seasons; for the sun would always shine from pole to pole, and its rays would be directly overhead to those only who live on the earth's Equator. But the earth being inclined, the sun is a portion of the year overhead to the people who live twenty-three and a half degrees north of the Equator, and also overhead a portion of the year to those living twenty-three and a half degrees south of the Equator. This great belt that runs around the earth, reaching from twenty-three and a half degrees north of the Equator to twenty-three and a half degrees south of the Equator, receives the vertical rays of the sun. The northern limit of this belt is the *Tropic of Cancer*, and the circle twenty-three and a half degrees south of the Equator is called the *Tropic of Capricorn*. This makes the hot belt around the earth between these two circles forty-seven degrees wide.

In the summer the sunlight shines twenty-three and a half degrees beyond the pole, and in the winter twenty-three and a half degrees short of the pole. A circle run-

ning through these two points around the North Pole is called the Arctic Circle. This circle around the South Pole is called the Antarctic Circle. The Arctic Circle incloses the North Frigid Zone, and the Antarctic Circle incloses the South Frigid Zone.

You see that the belts of climate, the difference in the length of the day, and the changing of the seasons, are all due to two things: (1) to the earth's journeying about the sun; (2) to the inclination of the earth upon its axis.

The Lord says that He makes the summer and the winter; then of course He makes the spring and the autumn. These seasons are all necessary for the sowing, the growing, the harvesting, and the resting. The resting of the land during the winter enables it to produce more bountiful crops.

The moon works with the sun in imparting light and heat to the earth. The earth needs a rest from the bright rays of the sun, and yet some light is needed. The moon catches the intense light and heat of the sun, and reflects them to us, giving to the earth a soft, subdued light and heat which put mother earth and her children to sleep. On the morrow the sun wakens them again, and there is another day of life and activity. We need to sleep in order to thrive and grow. So does the earth need rest, that the plants and animals that are in it may thrive.

**Spell and define**

| | | | | |
|---|---|---|---|---|
| ver′ nal | sol′ stice | Cap′ ri corn | Frig′ id | or′ bit |
| e′ qui nox | trop′ ic | Tor′ rid | sea′ son | di′ a gram |
| au′ tumn | Can′ cer | Tem′ per ate | de gree′ | in clined′ |



**Questions**

1. For what were the sun and the moon ordained?
2. How many seasons are there?
3. What are the two causes that produce the seasons?
4. How much is the earth's axis inclined?
5. Because of this, how much is the sun declined each side of the Equator?
6. Beyond what degree north and south of the Equator does the sun cease to appear directly overhead?
7. What are the circles that mark this limit on each side of the Equator called?
8. In every circle there are 360 equal divisions called degrees. From the North Pole to the South Pole is one half of a great circle. How far is this in degrees? What is the distance in degrees from the Equator to the North Pole? How far is it in degrees from the Equator to the South Pole?
9. If it is 23½ degrees from the Equator to the Tropic of Cancer, and 23½ degrees from the North Pole to the Arctic Circle, how many degrees wide is the North Temperate Zone?
10. What is the width, in degrees, of the South Temperate Zone?
11. For what purpose does God make the seasons?
12. Every degree is about 70 miles in width. Find out the width of the zones in miles.

**Note Book Requirement**

On page 62 make a diagram showing the change of seasons.

# Lesson LXVI

## *Time and Timekeeping*

**Blessed be the name of God forever and ever: for wisdom and might are His: and He changeth the times and the seasons. Dan. 2:20, 21.**

The sun and the moon were not only to be for "signs and for seasons," but also "for days and for years." In our study of the solar system we have observed how the sun marks off the days and years of each planet, and how the moon measures off the months by its journey around the earth, giving to us twelve months every year, each month consisting of about thirty days.

What is a day? How is it measured off? It is the same now as it was during the first week of time, and it is measured off in the same way. Speaking of the first day of time, God's word says, "And God called the light *day;* and the darkness He called *night.* And the evening and the morning were the first day."

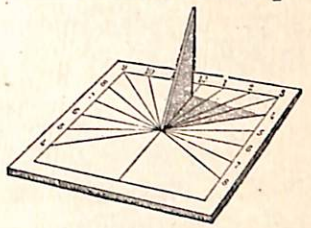
Every day (now, as then) has a light part which we call day, and a dark part which we call night. The darkness and the light pass around the earth in a period of twenty-four hours, which results from the earth's rotating on its axis. Each hour is divided into sixty equal divisions called *minutes*, and each minute is divided into sixty equal divisions called *seconds.*

We give names to the days of the week and to the months, but the years are all numbered. The count began about the time that Christ was born, more than 1900 years ago. Every one hundred years is called a *century.* Columbus discovered America in 1492, which was in the

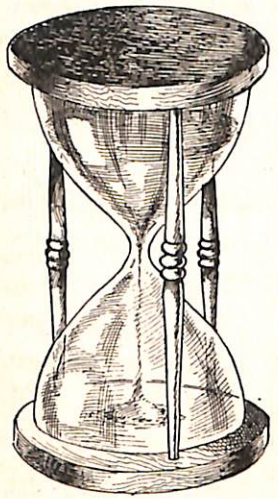


fifteenth century. The "Pilgrim Fathers" landed in America in the seventeenth century. We are now living in the twentieth century.

But I hear some one ask how correct time has been kept all these centuries. Of course, you know that we use the watch or clock to keep a record of the time now. But did you know that the sun is the *real* clock, and we have to set our clocks and watches by it? The ancients used the sundial, which indicated the time by the shadow which it cast. They could not tell the time of day except when the sun shone. Another clock was the hourglass, which consisted of a glass vessel having two divisions. These were so arranged that a quantity of sand, water, or mercury occupied an hour in running through a small opening into the lower half. This clock had to be watched closely so as to be inverted just as the substance stopped running, or the clock would lose time.



THE SUNDIAL



THE HOURGLASS

A watch or clock is simply a little machine with steel springs or weights which drive the hour hand around a dial in twelve hours. All clocks, of whatever kind, have to be set either by the sun or by the stars. When the sun is highest in the heavens, then it is noon; twelve hours later, it is

midnight; and twelve hours later still, it is noon of the next day.

Because the earth turns on its axis from west to east, the sun appears to travel from east to west across the sky. It rises in the east and slowly climbs up higher and higher until at last it begins to descend toward the western horizon.

It is clear that as the sun travels from east to west it will pass over a city in the eastern part of a country before it will pass over a city farther west. At noon in a western city, it is already afternoon in an eastern city; and so, of any two places, the eastern one always has the later time. Thus it is the sun that gives us our time. When one travels from an eastern city to a western city, he will find that his watch needs resetting. It must be changed to earlier time. If he were to travel from a western to an eastern city, his watch would have to be set forward, because in that city it is later in the day.

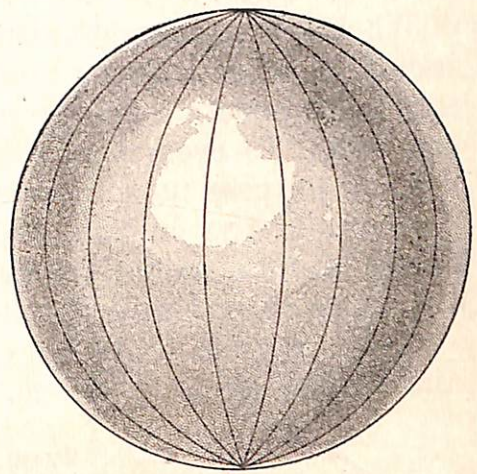
Let us think of the earth as a great ball, and imagine that a series of great circles are drawn around it passing directly from the North Pole to the South Pole. Such lines, running north and south upon the globe, or map, are known as *longitude lines;* and it is by means of these lines that we measure the distance in degrees east and west around the earth.

As we have already learned, there are three hundred sixty degrees in a circle, and the earth turning once upon its axis every twenty-four hours causes the day to make its circuit around the entire circle in the space of twenty-four hours. If the sun travels over three hundred sixty



degrees in twenty-four hours, in one hour it will travel just one twenty-fourth as far, which is fifteen degrees of the great circle around the earth.

Now, if two cities are fifteen degrees apart, they have really an hour's difference in time. If they are thirty degrees apart, there will be two hours' difference in time. If a certain city is forty-five degrees east of another city, how much earlier is the time of the western city? If it is known that a certain city is one hundred eighty degrees either east or west of another city, we can tell at once that the difference in time will be twelve whole hours.



GLOBE SHOWING LONGITUDE LINES

Longitude is counted both eastward and westward from Greenwich. Greenwich is a town near London, in England, where is built the British Royal Observatory, one of the oldest and most important observatories in the world.

On the map, a line has been drawn near the 180 degrees longitude circle, away out in the Pacific Ocean, on the opposite side of the world from Greenwich; and it has been decided that all lands on the east side of this line shall count their longitude west from Greenwich, and those west of the line shall count longitude east from Green-

wich. At this line the day begins and travels westward, crossing first the islands along the coast of Asia, and then the continents of the Eastern Hemisphere, on across the Atlantic Ocean, the Americas, and last of all many of the islands of the Pacific. When sunrise reaches places east of the *day line* in the Pacific, a new day has begun.

What a necessary thing time is! And when we do not observe it, what disorder and confusion reign! Let us learn to be punctual and prompt in all things. The wise man said, "To everything there is a season, and a time to every purpose under heaven."

God is always on time. All the worlds in space move exactly on time, so that astronomers can tell years ahead just when an eclipse will take place. Since the Creator is always on time, let us always be on time, and not keep Him waiting on us to do our heaven-appointed work.

**Questions**

1. For what purposes were the sun and the moon created?
2. What time is marked off by the sun? By the moon?
3. How does the sun measure off the day and the year?
4. How does the moon measure off the days that make the month?
5. Of what does a day consist? Has it always been so? Give proof.
6. Name the seven divisions of time, and define each.
7. What are the present means used for keeping time? What devices did the ancients use?
8. What is the real clock by which all our timepieces are set?
9. Who is the great timekeeper? Does He do all His works on time? Give proof of this.
10. What does Solomon say on this question of time? Eccl. 3: 1-8.



# Lesson LXVII

## *Fixed Stars and Constellations*

Seek Him that maketh the seven stars and Orion. Amos 5: 8.

Venus, Mars, Jupiter, and Saturn, can be readily seen with the naked eye at certain times, Venus and Jupiter appearing brighter than any other stars in the heavens. If you watch any of these from night to night, you will notice they seem to be wandering and shifting about among the other stars. In fact, they are called planets because of this habit.

ORION

All stars except planets are called "fixed stars," because they always keep the same position with reference to each other. These fixed stars, unlike the planets, shine with their own light, and for that reason are all supposed to be suns which have planets revolving about them, like our own sun.

Our sun, you will remember, is 93,000,000 miles away, and it takes eight minutes for its light to come to us. But the sun next nearest to us (Alpha Centauri) is much farther away than our most distant planet, Neptune. It requires a little over four hours for the light of Neptune to reach our earth; but so far away is this second sun, that it requires about four years for its light to pass

through the twenty-five trillions (25,000,000,000,000) of miles of space between it and our earth. So enormously distant is this sun that, if it should be instantly blotted out of existence, still its light would continue to come to us for four years.

Over six thousand of these suns are visible to the naked eye, but the telescope brings to view over one hundred million (100,000,000) more. I will name four other suns which shine brightly in the heavens. These your teacher or parents will help you to find. The bright star Sirius, sometimes called the "Dog Star," is so far away that eight and a half years is required for its light to reach the earth. The light time for Vega is more than twenty years; for Polaris, the North Star, about fifty years; and for Arcturus more than one hundred years. What a great universe is this! And what a great God is He who made it and filled it with unnumbered worlds! Once, when David was studying astronomy and thinking of the God who had numbered all the stars and given to each one its name, he exclaimed, "Great is our Lord, and of great power: His understanding is infinite!"

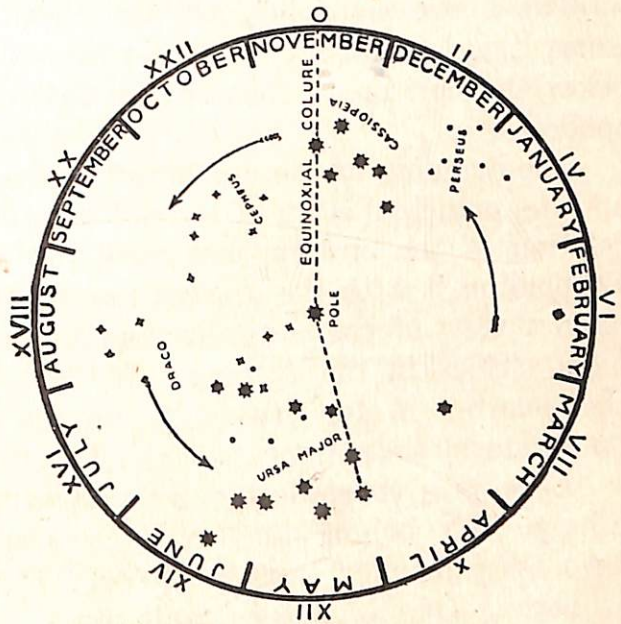
When the ancient Babylonians and Greeks studied the heavens, they grouped the fixed stars together, and called them *constellations*. The imagination of these ancient astronomers was very keen, and they grouped the stars together in such ways as to picture human beings, and animals of all kinds. These creatures were pictured as active, sometimes living in peace, and sometimes at war, killing and devouring one another.

When you look at the constellations, you will not be



able to see all that they thought they saw. I will give you the names of just a few of the most familiar constellations, and with the help of your teacher and the accompanying map you will be able to find them.

Ursa Major, the "Great Bear," called also the "Big Dipper," you can perhaps already point out in the heavens. There is nothing to suggest a bear, but it does resemble a dipper with a bent handle. This constellation moves about Polaris, without setting, in the North Temperate and North Frigid Zones. The two stars of this dipper farthest from the handle are called pointers, because a line drawn through them always points to Polaris.



CASSIOPEIA

Ursa Minor, or "Little Bear," also known as the "Little Dipper," is not quite so easy to find. From Polaris a curved line of small stars forms the handle of the Little Dipper. Finding the handle, you will soon find the rest of the dipper. Polaris is at the end of the handle.

Cassiopeia is a constellation named in honor of a queen. Opposite the handle of the Big Dipper, and at about the same distance from Polaris, you will find the five principal stars, forming the letter W, or a tipped-over chair with a broken back.

The above constellations are called *circumpolar*, because they go about the polestar, Polaris, not going below the horizon to those living in the Northern Hemisphere.

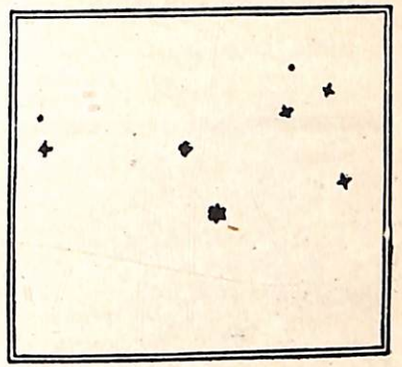
The drawing of the northern sky, representing Polaris and the principal stars of the northern heavens, shows the relation of the circumpolar constellations to each other. By holding it with the present month at the top, we shall have a view of the constellations as they are seen about eight o'clock in the evening. It also shows how to find the polestar in the center by the direction of the two outer stars, or pointers, in the Great Bear.

*Lyra* is a constellation which is supposed to suggest a harp. The bright sun-star Vega is in this constellation. Two other smaller stars near Vega form with it a little triangle. One of these small stars is really two, and both of these can be seen by one having good eyes. Have you good eyes?

A group of stars in the constellation Leo (the Lion) has the form of an ancient sickle.. The bright star Regulus forms the end of its handle. *Corona* is the shape of a crown. Another group is the shape of an arrow. Two constellations are mentioned in the Bible, Orion and the Pleiades, called also the seven stars. Orion has three stars in straight line called the bands of Orion. The



Pleiades, sometimes called also the Little Dipper, consist of seven small stars close together, having the form of a dipper. The Lord asked Job this question: "Canst thou bind [hold in check] the sweet influences of Pleiades, or loose the bands of Orion?" Some astronomers, by their study of the heavens and this verse of Scripture, are led to believe that the Pleiades are the center of the universe, and that the bands which hold Orion are the result of the sweet *influences* of the Pleiades, which go out to Orion and to the myriads of worlds and hold them in place.



THE PLEIADES

Let us seek Him who made the seven stars and Orion, that we may know His upholding and guiding power in our lives.

**Spell and pronounce**

| | | |
|---|---|---|
| con stel la′ tions | Ve′ ga | Le′ o |
| Sir′ i us | Co ro′ na | Ly′ ra |
| Cas si o pe′ ia | Po la′ ris | O ri′ on |
| Al′ pha Cen tau′ ri | Arc tu′ rus | Ple′ ia des |

**Questions**

1. What will happen to the constellations in the day of God's wrath? Isa. 13:9, 10.
2. What is the influence of the right study of the heavens? Ps. 8:3, 4.

**Note Book Requirement**

On page 64 make a map showing the circumpolar constellations.

## CHAPTER VIII

# WATER ANIMALS

*(Scripture Basis, Gen. 1:20-23)*

*"And God said, Let the waters bring forth abundantly the moving creature that hath life."*

## Lesson LXVIII

### *The Waters Bring Forth Abundantly*

**O Lord, how manifold are Thy works! in wisdom hast Thou made them all: the earth is full of Thy riches. So is this great and wide sea, wherein are things creeping innumerable, both small and great beasts. Ps. 104:24, 25.**

The air and the land are the homes of a large number of creatures of different shapes and sizes. But the rivers, lakes, seas, and oceans contain a much larger number of animals, both great and small. This is in harmony with God's command when on the fifth day of creation week





He said, "Let the waters bring forth *abundantly* the moving creature that hath life." The psalmist expresses the same idea where he speaks of the "great and wide sea, wherein are things creeping innumerable."

It may be that you have never had brought to your mind the great wealth of not only animal life, but also plant life, that inhabits the seas, and have supposed that the most abundant life was on the land. But if you could take a submarine voyage around the world, you would be greatly surprised and delightfully entertained in viewing the wonderful scenes of life that would greet the eye at every turn. "They that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and His wonders in the deep." David probably refers to what the divers see while collecting coral, pearl, and sponge in the sea. This business was carried on anciently as well as at the present time.

IN A FISH TANK

Many of the animals, such as the corals, sponges, and sea anemones, are plantlike in their appearance, being stationary. In looking at these plantlike animals, you would think you were looking at a flower garden having bright, beautiful blossoms resembling daisies, lilies, and asters.

Besides all the make-believe plants, there are many true plants. Among them are the seaweeds, which have no true roots, being carried about by the waves or clinging

to the rocks and shells by suckers. The seaweeds vary greatly in shape and color. Some are fine as hair, others are like graceful plumes or silken tufts, and many are broad and bright like ribbons. Still others are hundreds of yards long and twisted as ropes. The beautiful pinks and brilliant reds are found in the lowest depths; and the dull browns and olive green grow above them, and are often washed upon the beach. Millions of small sea creatures cling to the seaweeds, some of them too small to be discerned by the unaided eye.

Numerous small fish, and queer shaped, beautifully colored shell creatures, besides a host of others which we can not mention, play and forage throughout these sea gardens. And there are the larger creatures, as the sharks, dolphins, and whales, which move about in droves and herds, passing and repassing one another, sometimes engaging in battle, and devouring one another. If we could take our position at the bottom of the sea and look upon the curious creatures as they pass by, surely we would come to regard their sea home as a wonderful place.

**Spell and define**

| | | |
|---|---|---|
| psalm′ ist | cor′ al | shark |
| in nu′ mer a ble | a nem′ o ne | dol′ phin |
| a bun′ dant ly | sponge | whale |

**Note Book Requirement**

Copy on page 68 Ps. 104: 24-28; 107: 23, 24.



# Lesson LXIX

## *Shell Creatures*

**Give not that which is holy unto the dogs, neither cast ye your pearls before swine, lest they trample them under their feet, and turn again and rend you. Matt. 7: 6.**

Captain John Smith came over to America in an early day to start a colony in Virginia. He was much in love with his new home, and about 1626 he wrote a book on the natural attractions in Virginia. Among other things, he mentions some creatures that he found living in the bays along the shores. He says, "You shall scarce find any bay or shallow shore, or cove of sand, where you may not take many *clamps*."

ON THE BEACH OF A MICHIGAN LAKE

This water animal has changed its name a little since three hundred years ago; but it can clamp, or hold tight, just as well as ever. Now do you know the name of this creature? If not, just take the *p* off from "clamp," and you have it. If you have an opportunity, try the clamping power of the *clam*, or fresh-water *mussel*, by placing a stick between the *valves*, the platelike shells of the animal. True clams are salt-water *mollusks*, while the clams that live in fresh

water are called *mussels*. *Mollusk* is the name given to creatures having a soft body inclosed by a shell.

If you do not live near a body of water, so that you can secure from it a clam or mussel, you may be able to obtain some at a fish or meat market. A close relative of the clam, the oyster, you will find no difficulty in securing; for it is a common article of diet, even though it is a very unclean animal. It has been called the scavenger of the sea, because it eats all kinds of filthy things. It is in the sea what the hog is on the land.

The oyster has many enemies. The principal ones are the starfish, soft crab, drill fish, a bird called the oyster catcher, and man. The starfish perhaps is its worst enemy. Men capture and destroy the starfish, because it destroys so many oysters. Formerly they broke the five-rayed starfishes into pieces, and cast them back again into the sea. But to their surprise and regret the starfishes increased instead of diminishing. Later it was learned that each ray of the animal developed into a new starfish.

A UNIVALVE

Let us examine a clam and see how it is built. Its two shells open and shut like the covers of a book, with a hinge at the back. Because they resemble in their action the tight-fitting valve of a pump, they are called *valves*. A mollusk having two shells is a *bivalve;* while one which has the shell all in one piece, like the snail, is a *univalve*.



A bivalve is at first a small creature, having developed from an egg. A soft, fleshy cloak called a *mantle* surrounds the body, and this begins to form a shell out of the limestone in the water. This growth may be represented by the shingling of a house, only in the shell the shinglelike layers grow from the hinge to the outer edges, while in a house they are placed from the outer or lower edges to the peak. You can easily see these layers of growth on the valves. They remind one of the rings of growth in the trunk of a tree.

A BIVALVE

How does the clam keep its valves closed so tightly? There are two strong muscles on the inside which extend from one valve to the other. These muscles work as yours do when you bend your arm, and thus they hold the valves together.

How do the valves open? Not by muscles, as in straightening the arm. Take a small rubber eraser and place it in the center of your book. Now press the covers together. You press to shut the book, but the elastic rubber keeps it open. The clam has a similar contrivance for keeping the valves open, which requires no effort, and which throws the valves apart when the animal dies.

Let us take a peep inside a clam whose valves have been carefully separated by a strong knife. It appears to be nothing but a soft, jellylike mass. But, while the animal has no well-developed head, yet it has a mouth, heart, stomach, and gills. The part of the body that is pushed out near the larger end of the clam is called the foot. This it uses in traveling and digging in the sand.

The portion that is pushed out at the small end is called the *siphon*, and it consists of two tubes. Through one the water enters the body, carrying the clam its food. The water passes out of the body through the other tube, after passing through the gills.

Some clams are very large and powerful. In the tropical seas a giant clam was captured that weighed four hundred ninety-eight pounds. It is said to have furnished food for one day for one hundred twenty men. So great was the muscular strength of the creature, that in closing its valves it cut the cable of the ship in two.

OPENING PEARL SHELLS

The shells of the clam and oyster are used by the natives as dishes in eating and cooking. These shells, especially those of the oyster, are also used for making knife handles, card cases, and ornaments. The oyster furnishes us with the costly pearl. Do you know how the oyster makes the pearl? A small grain of sand sometimes gets between the shell and the mantle, or lining, and causes an irritation to the tender flesh, as when a cinder gets into the eye. The oyster in its pain tries to relieve itself, and secretes a soft fluid about the grain of sand. This in time hardens, and forms the goodly pearl. So in our lives some of the most precious things come to us through suffering. What a fit symbol the



pearl is of eternal riches, which are gained through much tribulation.

**Questions**

1. How did the clam get its name?
2. What is the fresh-water clam called?
3. What is the general name for all shell creatures? What does it mean?
4. Name a near relative of the clam. What are its eating habits?
5. Name the enemies of the oyster and the clam.
6. How have men been deceived in starfish?
7. Describe the valves of the clam. How are they developed?
8. Name and define the two classes of mollusks.
9. Describe the inner structure of the clam. How does it travel? How does it obtain food?
10. How does it open and close its valves?
11. Describe the giant clam.
12. Of what value are clam and oyster shells?
13. How are pearls formed? Of what are they used as a symbol? Matt. 13:45, 46.
14. What city will have very large pearls? Rev. 21:2, 12, 21.

**Note Book Requirement**

On page 69 make drawings of mollusks having two valves.

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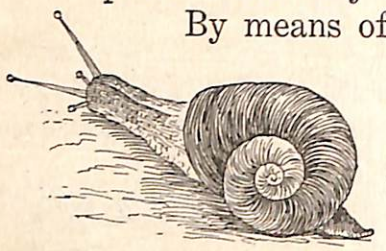
## Lesson LXX

*Shell Creatures (Continued)*

"Slow as a snail." This expression we often hear applied to people who are slow and lazy; but when we consider how poorly a snail is provided with means for

traveling, we shall find that it moves quite rapidly. It has no legs, and but a single foot, and that consists of a part of the body which is extended from the shell. By means of this foot, it moves itself about. When we remember that this creature carries its house with it, on its back, it ought not to be blamed for its lack of speed.



LAND SNAIL

The snail is a well-known member of the shell family. It is much more highly developed than its near relatives, the oyster, the clam, and the mussel; for it possesses a head, which the others do not. It is provided, also, with feelers, ears, and eyes. The snail has a real mouth and hard jaws; also a long; ribbonlike tongue, which is covered with teeth, and which works against the upper jaw, thus masticating the weeds upon which it feeds.

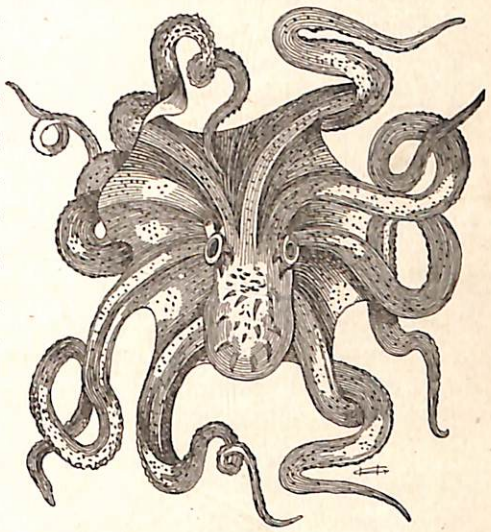
The common land snail has a spiral shell, whose spire is very short, and whose body whorl is very large. The pond snail also has a spiral shell, which is conical in shape. The pond snail has but two feelers, while the land snail has four. The eyes of the pond snail are at the base of its feelers, while those of the land snail are at the upper end of the two higher feelers, or horns.

The oyster, clam, and mussel are water-breathing animals, while the snail is air-breathing. This animal has a little sac which answers for lungs. The pond snail, after remaining in the water for a time, comes to the surface, and sets free the bubble of air which it has used, and



takes a fresh supply before descending again. There is a time when snails are in a torpid condition. During that period they remain in the shell, with the mouth tightly closed by a sticky fluid, which hardens by exposure. They are in this condition during cold weather, also during exceedingly hot weather.

Besides the clam, oyster, mussel, and snails, the shell family includes the nautilus, octopus, cuttlefish, and a host of other creatures of various sizes and shapes. The cuttlefish and octopus attain an enormous size.



OCTOPUS

The cuttlefish, also called the squid, varies in length from a few inches to forty or fifty feet. It has ten arms for grasping and holding its prey. Eight of these are short, and two very long, sometimes reaching thirty feet. Like tree toads and chameleons, it can change its color. If pursued by an enemy, it empties its ink bottle into the sea and escapes in the dark. The cuttlefish furnishes the cuttle bones used in bird cages.

The octopus is so fierce that seamen call it the devilfish. It has two large eyes, and eight very long arms by which it destroys its victims. It also has an ink bottle. Its ink becomes the sepia used by artists in water colors.

Questions

1. To what shell creature is a lazy man compared? Which has the better excuse?
2. How does the snail travel? Compare it with the clam as to its structure.
3. Describe the common land snail.
4. Describe the pond snail.
5. How do snails breathe?
6. How do they protect themselves?
7. Name other members of the shell family.
8. Describe the cuttlefish.
9. Describe the octopus.
10. How does the octopus escape its enemies?

Note Book Requirements

1. On page 70 make drawings of mollusks with which you are familiar, having one valve.
2. On page 71 describe the strange creatures there pictured.

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## Lesson LXXI

*Crusty Creatures*

The crawfish is a member of the *crustacean family.* The members of this family are called *crustaceans* because the entire body is covered by a hard crust, or shell. Should you not find any crawfish swimming about in the water, you may perhaps discover one by overturning stones or sticks which make for it a hiding place at the bottom of a stream or pond.

The body of the crawfish is divided into three main parts, the head, the thorax, and the abdomen.



Attached to the thorax are sixteen legs. The first three pairs are very small, and are used mostly in breaking up and chewing the food. For this reason they are sometimes called foot-jaws. The next pair are the great claws which are so freely brandished when the crawfish is disturbed.

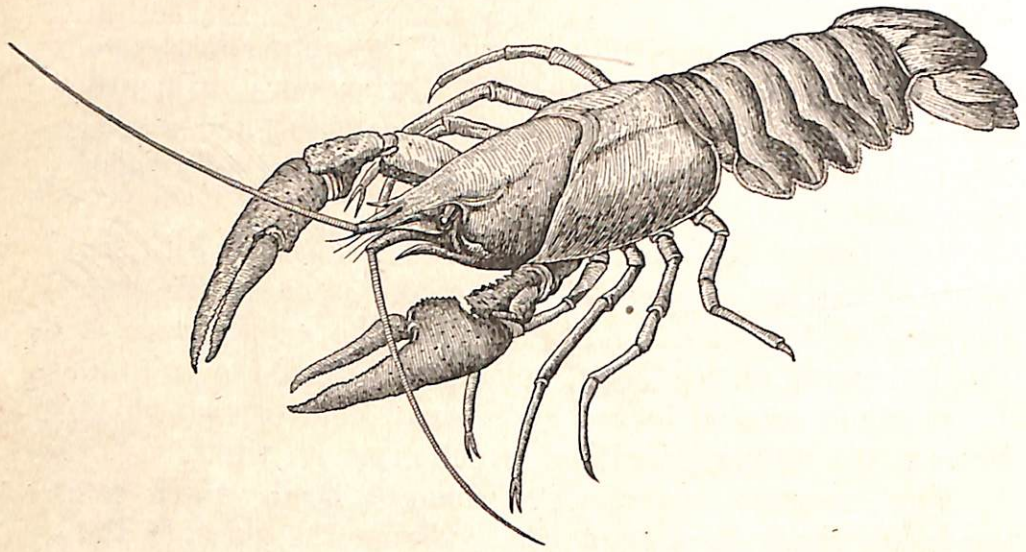
If you notice carefully, you will see that these two great claws are not exactly alike. The more awkward one has coarse teeth, and is used for catching and crushing its prey. Back of the two great claws are four pairs of walking legs.

Just behind the walking legs is the abdomen, with six pairs of smaller legs, called *swimmerets.* These are used as paddles for swimming. Back of the *swimmerets* is the last joint of the body, sometimes called the tail fin. It is capable of a backward and forward movement, which propels the animal in either direction at its will.

The crawfish has a well-developed head, which extends forward, forming a beak. From the sides of the head extend outward two whiplike feelers, by means of which it examines the objects it meets. It has also well-developed eyes, which stand out on the ends of two rods, or stalks, one on each side of the head. These stalks can be moved forward and backward, as well as sidewise, so that it can see in all directions without turning its head.

Crawfish breathe by means of gills, which are located on the sides of the body, just underneath the saclike jacket which nearly envelops the entire body. These gills are hairlike tufts, easily found under the jacket at the point where the legs join the body.

The young of the crawfish are developed from eggs, which are laid in the spring of the year. They cling to the swimmerets; and after hatching, the young continue to cling to the swimming legs of their mother until they are about one third of an inch in length. At this stage



CRAWFISH

they have bright blue eyes, and a pair of small feet. They move about in the water in a very lively way. In three months they are full-grown, and begin the battle of life in earnest. As they grow, their hard outer covering becomes too small; so they shed their coats five or six times during the first year, a larger coat coming with each change.

The crawfish is well adapted to its home and manner of life. It is a scavenger, living upon dead fish and other animal matter which it finds on the bottom of muddy



creeks and ponds. Can you not see God's care for our health in thus providing for the disposal of unhealthful and decaying matter? Sin brings decay and death to all around us, but even under such conditions our best good is constantly prominent.

The crawfish has many relatives in both salt and fresh water. One of these is the lobster, which resembles the crawfish very closely, but it is a sea animal. The crab is another member of this family. It, too, resembles the crawfish; but having no abdomen, or rear portion of the body, it is nearly circular in shape. The crab lives in salt water.

HERMIT CRAB

The hermit crab is a curious member of the crustacean family. It thrusts its tail into the shell of some dead mollusk, and makes that its home. If it can not find an empty shell, it kills some creature, drags it from its house, and takes possession of that until a larger one is needed. So the hermit crab may well be called a robber. It robs others of what they have worked long to build.

Some very remarkable crustaceans called *trilobites* are found in the rocks, having been buried there by the flood. None are alive to-day.

**Spell and define**

crus ta′ cean
swim mer ets′
ab do′ men
mol′ lusk
tho′ rax
pro pel′

**Questions**

1. To what family does the crawfish belong? Why is this family so called?
2. Name the three divisions of the body.
3. How many pairs of legs does the crawfish have? Locate and describe each pair.
4. Describe the head, eyes, and feelers.
5. How does the crawfish breathe? Where are the breathing organs?
6. How does it multiply?
7. Describe its molting process.
8. Where and on what food does the crawfish live?
9. Name some of its relatives.
10. Describe the hermit crab. What other creatures sometimes manifest its spirit? Matt. 23:14.

**Note Book Requirement**

On page 72 write a brief story about the crawfish, naming all its parts, and telling what you can about where it lives and its food.

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## Lesson LXXII

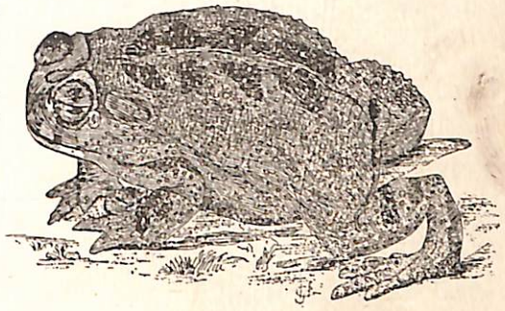
*The Toad*

The toad is a member of the frog family, and so is an *amphibian*. This means that it belongs to a class of animals which make their homes both in water and upon land. What a wonderful nursery and cradle are not only the waters of the great deep, but also the shallow waters of our creeks and ponds!



The toad is much like the frog in appearance, but it has a thicker and shorter body, the upper part of which is covered with warts. Unsightly as you may have always considered it, the toad is lovely in the eyes of those who know it and understand its true worth.

The toad is the friend of the garden, because it is the enemy of the slug, the rose beetle, the squash bug, the roaches, and many other annoying garden pests. Therefore all who are interested in their plants, vines, and trees, should treat the toad with a great deal of respect.



TOAD

If you have never made its acquaintance, look for it in your garden. It may be hidden away in some moist, sheltered spot, awaiting the twilight shadows or a cool shower to entice it forth. Always at sundown it will come out and begin a wide-awake search for food. Then you will enjoy watching it.

The toad has no teeth. But its curious tongue, like that of the frog, is well fitted for catching moving insects; and its long, wide stomach can contain a surprisingly large number of them. Nothing seems to escape its bright eyes; and although it is not good at running, and has no visible means of defense, it hops fearlessly about, or waits patiently, all unnoticed by the passing insects until a flash of the pink tongue whisks them out of sight.

Then it waits again, motionless and clodlike in appearance, until another morsel of food presents itself.

Because the toad looks like the clods of earth over which it crawls, it is much more secure than it otherwise would be. Brightly colored toads are always the first ones to be snapped up by their enemies, while those that resemble the clods may entirely escape.

In addition to this valuable means of protection, the toad has at least one means of defense. From glands behind its head it can send out a whitish fluid which is somewhat biting and offensive, although not poisonous. Doubtless this is the reason why both the cat and the dog have learned to keep a respectful distance, and the toad is given undisputed right in the garden as far as they are concerned.

If food is abundant, the toad will eat greedily and produce eggs in great number. These eggs are deposited in long ropelike strands in the quiet water of some near-by pond or pool. Early in the spring we may find them there in clear, bright masses. Each egg is about as large as a small pin head at first, black above and light below. These are left in the water by the mother toad, who then returns to the garden whence she came. She depends upon the water to hatch and feed her young.

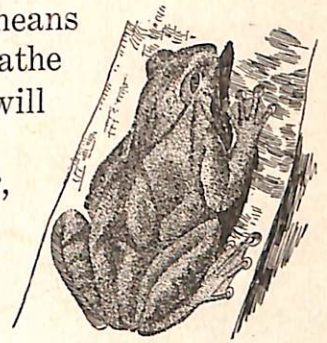
It is very interesting to watch the tiny eggs lengthen, and to see them develop into flat little tadpoles. These tadpoles grow remarkably fast; and if all goes well, soon the hind legs appear, then the fore legs, the tail disappears, and a perfect little toad hops out of the water.



This all happens within a month from the time when the egg was laid.

If you can arrange a pool for the toads in your garden, you will enjoy watching them develop there, and you can raise your own garden toads. If you protect these, they will reward you by protecting your plants. Toads may be tamed. It is said that a pet toad knows its friends, and that one was once kept by a family for thirty-six years.

It is interesting to watch the development of the eggs from day to day in the school aquarium; and you will observe that the little tadpoles are not only of much interest, but are also of use in the aquarium, keeping it free from the slime that gathers upon the stems of water plants. This they scrape away by means of their horny little jaws. They breathe through feathery gills, which you will find on the sides of the head.



TREE TOAD

When ready to leave the water, the gills disappear, and lungs take their place. Like the frog, the toad has no ribs, and so can not breathe as we do. It takes a mouthful of air, then closes the mouth and nostrils, and swallows the air. Its skin is capable of absorbing both air and moisture.

Both toads and frogs have four fingers in front and five toes behind. The fingers and toes of the tree toad end in remarkable little cuplike suckers. By means of these, the tiny climber is able to make its home upon the trunks and limbs of the trees.

In winter the toad is inactive, having buried itself under a stone or in some other safe place. Here it stays until the frost is out of the ground. Then again it comes forth "to swell his bagpipe in the marshes and fill the night with music."

**Note Book Requirement**

Write a brief story of the toad's life, and illustrate by drawings representing different stages of growth. Mention at least one good lesson that you have learned from the toad.

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## Lesson LXXIII

*The Reptile Family*

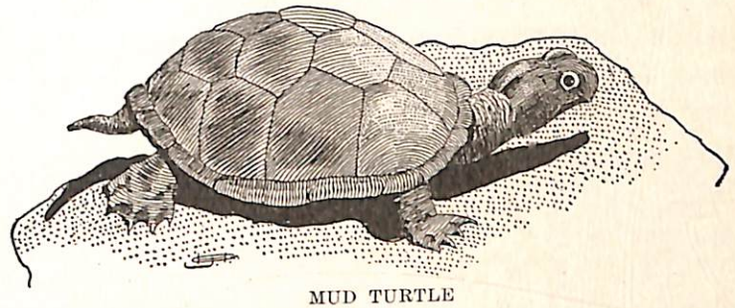
The lizard belongs to a large family of animals called *reptiles*. In many ways reptiles resemble birds. They have the eyes of a bird, and their eggs resemble those of a bird; but the scales of the bird are more highly developed into what are called feathers, and the eggs of the reptile are not covered with a hard shell. Serpents are reptiles; and it is said that the first serpent was provided with wings. Great winged serpents, now extinct, once lived upon the earth.

LIZARD

The *turtle* also is a member of the reptile family. It carries its house on its back, this house, or shell, forming a protection to the body, and enabling the occupant to resist the attacks of its enemies. The shell is covered with horny plates.



Those taken from a certain kind of sea turtle, are the tortoise shell from which beautiful combs are made. Some of these great sea turtles grow to an immense size, and it is said that a single turtle may weigh as much as four hundred fifty pounds. Our common turtle likes to live both on land and in the water. The eggs of the turtle are soft-shelled, and are deposited in the sand, where they remain until they hatch.



MUD TURTLE

The *horned toad*, so called because of its resemblance to our common toad, has its body covered with little spines. It is not really a toad, but a lizard. This creature lives on the dry, sandy plains of the West. It is perfectly harmless, and pretends to be dead if in any way molested. It can be easily tamed, and will take food from the hands of its friends. Like nearly all lizards, it does much good by destroying beetles and other harmful insects.

HORNED TOAD

The *alligator* and *crocodile* are the largest members

of the reptile family. These animals live only in tropical climates, in such waters as the Nile, the Zambezi, the Amazon, and the Ganges. The alligator and the American crocodile are found in the swamps and rivers of Florida. The largest alligators are about twelve feet long, while the crocodile sometimes grows to the length of twenty feet. Like other reptiles, these immense creatures lay eggs and leave them in the sand to hatch.

There are many more creatures living in the waters, of which it would be interesting to learn; but much of this work must be left for future study. Read what the psalmist says about God's care for His creatures, and their dependence upon Him. Ps. 104: 24-30.

**Questions**

1. Where do we first learn of the serpent, or snake?
2. How are people disposed toward this creature?
3. What curse did the Lord pronounce upon the serpent? Why?
4. Of what family is the snake a representative?
5. What higher form of scales cover the body of a bird than those which cover the bodies of reptiles?
6. Of what great water animal have we a description in Job 41?

**Note Book Requirement**

Upon pages 74 and 75 record your observations of one or more of the creatures there illustrated, telling where they live, what they eat, where they spend the winter, how they protect themselves from their enemies, of what good they are, and what lessons they teach you.

## CHAPTER IX

# AIR ANIMALS

*(Scripture Basis, Gen. 1:21, 22)*

*"Out of the ground the Lord God formed . . . every fowl of the air."*

## Lesson LXXIV

### *The Birds of the Air*

**Ask now . . . the fowls of the air, and they shall tell thee. Job 12: 7.**

When God created the animals, He provided for them three homes — the water, the air, and the land. All creatures were so made that they are adapted to live in one of these three homes.

As the Bible says, the birds were to "fly above the earth in the open firmament of heaven." For this reason they are spoken of as "the fowls of heaven" and "the fowls of the air."

How the birds could fly about in the air with nothing visible to hold them up, was a mystery even to the wise man. He says, "The way of the eagle in the air," "I know not." But after several thousands of years of study man has gained some knowledge concerning air navigation, and has had some success in making flying machines that will carry passengers through the air above the earth. But the conditions for flight must be favorable; for these ships of the air can not, like the birds, go against a strong wind. Man probably never will invent a flying machine that can go through the air with the ease and grace exhibited by the birds.

CREATED TO FLY

As we study the structure of different animals, we see how wonderfully their bodies are suited to the homes in which they live. The fish is adapted to live in

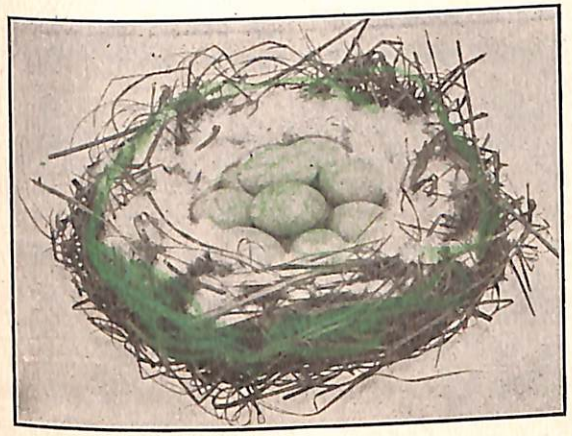
AN AEROPLANE, OR AIR SHIP



the water, the bird in the air, and the beast on the land. In studying any creature, let us observe how the all-wise Creator has constructed its body so that it is fitted for its surroundings. It has been so made that it might live a happy, joyful life. God loves to see His creatures happy.

CREATED TO SWIM

In our study of birds, we shall notice quite a difference in the structure of their bills, legs, and feet. These are adapted to their habits of life. The bills, legs, and feet of the birds that swim in the water, are very dissimilar from those of the birds that live on the dry land; but the birds that live neither in the water nor on the dry land, but between the two, in the wet, marshy places, have still different bills, legs, and feet.



A BIRD HOME BEFORE THE YOUNG ARE HATCHED

The nests, too, of birds vary greatly, not only as to the places where they are built, but also as to the materials used in building. A difference exists in regard to their food also.

Notice all these points in your study of each bird,

and make a record of it in a note book that you carry with you. It will be an interesting book to read afterward.

Do not hesitate to ask, "Why is this foot webbed?" "Why is that bill so long?" Ask all the questions you can about the birds. Ask these questions of yourself. Ask them of your teacher. Ask them of father, mother, brother, and sister. Yes, do what the Bible says, "Ask now . . . the birds of the heavens, and they shall tell thee."

**Questions**

1. How many homes did God provide for the animals? Name them.
2. What names are given to the birds because of their home?
3. To whom was bird flight a mystery?
4. What are men now trying to do to imitate the birds? How are they succeeding?
5. In our study of birds, what questions shall we ask?
6. What will the birds tell us, that some men will not? Job 12:9.

**Note Book Requirements**

1. On page 76 copy the Saviour's invitation found in Matt. 6:26.
2. On pages 77 and 78 give the names of birds that have bills and feet like those shown on these pages, and tell why they are so differently shaped.



# Lesson LXXV

## *The Scratching Family*

As the partridge sitteth on eggs, and hatcheth them not; so he that getteth riches, and not by right, shall leave them in the midst of his days, and at his end shall be a fool. Jer. 17:11. (See margin.)

The hen, turkey, and peacock are tame members of the scratching family, and with these we are quite well acquainted. The prairie hen, quail, and partridge are wild members of the same family. They have the same kinds of tools for scratching and pecking as have their tame relatives. These tools are well adapted to the life they live.

PARTRIDGE

The scratchers might fitly be called ground birds; for although they can fly and perch, yet the ground is their home. It is there that they find their food, make their nests, and rear their young.

These ground birds have a host of enemies. Foxes, coyotes, weasels, opossums, and rats contend with them on the ground; and hawks, owls, and eagles, in the air, are watching to devour them. These innocent creatures are in almost constant danger by day and by night.

Nearly every boy and girl who lives in the country is acquainted with Bob White. His true name is *Virginia partridge.* The *ruffed grouse* is a near relative of the Virginia partridge. In New England and the

North, this grouse is called a partridge, and Bob White a quail. In the South Bob White is called a partridge.

Bob White's habits are quite similar to those of his near relatives, the prairie hen, the ruffed grouse, the California helmet quail, and several other scratching birds.

The nest is made on the ground, usually in a tuft of grass under a bush. The mother bird lays from twelve to twenty eggs; and after she has sat on them three weeks, a very lively brood of quail chickens appears.

If you should come suddenly upon a hen quail with her chicks, you would see an interesting sight, and some very quick and queer actions. The mother would flutter at your feet, pretending to have a broken leg or wing. In thus attracting your attention and exciting your pity, she makes an opportunity for the chicks to run away and hide. Then, when you try to help her up, off she flies. Quail chicks early learn to hide quickly at a signal from their mother. Here is a good lesson on obedience.

When old enough, the brood fly away in flocks, keeping close to the ground. They can run swiftly. They roost on the ground instead of in trees or bushes, which would expose them too much to the attacks of hungry owls. When camping for the night, they crowd together in a close circle, with the tails at the center and their heads outward, ready, when surprised, to fly in all directions.

The *prairie chicken* of the Western prairies is larger than the quail. It has a tuft of feathers on each side of its neck which covers a naked, orange colored air sac. After filling this sac with air, it forces it out, producing



a peculiar booming sound, which can be heard a mile away.

In autumn and winter these birds go about in flocks of hundreds. They are easily tamed. Audubon, the "Bird Lover," caught sixty of them in early autumn, and, after clipping their wings, put them in a garden and an orchard. In about a week's time, they were not frightened at his coming to feed them; and before the winter was over, they would take food from his hand.

PRAIRIE HENS

The *ruffed grouse*, or partridge, found in eastern United States and westward, is a little larger than the prairie chicken, and is a much more beautiful bird. It prefers to live on the border of forests, in open woods, and in evergreen thickets. It is very graceful in its movements on the ground. It walks with a proud step, elevated head, the ruffs more or less raised, and its fine tail partly spread. It stands for a moment on one foot, then on the other, and at almost every step utters a soft cluck. It is among the wild scratchers what the peacock is among the tame, although its plumage is not nearly so showy.

When disturbed, the ruffed grouse lowers its head, spreads its tail a little wider, and runs rapidly into the thickest bushes. If there is no hiding place near, it takes wing with a loud whirring noise.

The pheasants of Europe and Asia, the beautiful golden pheasant of China, the sage hens of the Western

plains, the white and rock ptarmigans of Arctic America, are other members of the scratching family which invite our future study.

**Questions**

1. Name a few of the tame scratchers.
2. Describe their wings, feet, and bills.
3. How do the scratchers gather their food?
4. What do they eat?
5. Tell of some of the enemies of the scratchers.
6. What are Bob White's different names?
7. How do these birds guard against their enemies at night?
8. Describe the prairie chicken.
9. Describe the ruffed grouse.
10. Name other wild scratchers that we have not studied.
11. What lesson do you learn from Jer. 17:11? (Read margin.)

**Note Book Requirement**

On pages 79 and 80 write a brief description of the turkey, quail, and grouse.

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## Lesson LXXVI

*The Swimming Family*

How different are the swimmers from the scratchers! Why should they not be? They have an altogether different home. They live on the water, while the others live on the land. Catch a duck and a hen, if you have never done so, and compare the shapes of their bodies, bills, feet, legs, and feathers. Notice how well the body



and other parts of the duck are adapted to life on the water, and those of the hen to life on the land.

There are many kinds of wild ducks, geese, and swans, which look very much like our tame ones. Besides these, there are large numbers of other swimmers that inhabit the waters of different climes.

A SWIMMING BIRD — THE WILD DUCK

The *mallard*, or *green-headed duck*, lives in North America, and in nearly all parts of the Old World. Our common domestic duck came from this species.

The *summer*, or *wood duck* has very beautiful plumage. It builds its nest in the hollow of a tree or limb. If its nest is over the water, the young can easily drop into the water, where they feel perfectly at home. If the nest is away from the water, the young drop to the ground, and are either led or carried to the water.

The *red-headed duck* lives in North America, and gets its name from its brownish red head and neck.

The *snow goose* lives in North America, and is pure white in color.

The *Canada*, or *wild goose*, of North America, spends the winter in warm regions, but in the spring moves

northward in large flocks. Their spring migration usually takes place in either March or April, depending upon the season. They breed in the North, and linger there until the hard frosts warn them that the lakes and streams will soon be frozen over.

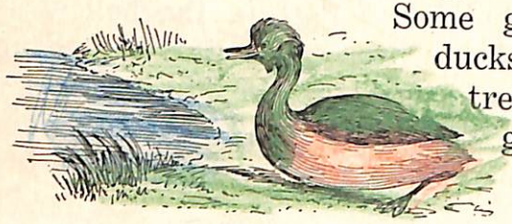
The *American swan* is found in North America. The young are brown, but when grown become pure white.

The *trumpeter swan* lives in western North America. Its notes sound like a trumpet. The body is pure white, with black bill and legs.

The *red-billed swan* and the *black-billed swan* belong to Europe. Our domestic swan is from the red-billed swan.

The wild duck is cunning. It dives to get away from the hunter, and then swims to shallow water, where it lies putting only its bill and nostrils out of the water, until the danger is past.

Geese and swans make a show of defense if they are annoyed, the goose by hissing, and the swan by whistling.



GREBE

Some geese, as well as some ducks, build their nests in trees. It is said that the geese in Richmond Park, England, roost on trees, and build their nests in old oaks, carrying their young to the ground under their wings. They were driven to this because when they made their nests on the ground the water rats destroyed their eggs.

The *grebes* are quite different from other water birds. They have short bodies and long, flat toes with lobed



webs. The legs are placed far back on the body. There are several kinds, and they live nearly all over the world. The most common is called "dabchick," and lives in our ponds. Some of the grebes have tufts of feathers which reflect the rays of light in beautiful colors. Their plumage is short and close. The body is a brownish color above, and usually white beneath.

The grebes do not seem to like to fly, but can and do fly long distances. They are great divers. Their food consists of water plants and small water animals.

They build their nests of waterweeds, which they pull up and form into little water rafts. In the center a shallow cup is formed, in which the eggs are placed. Thus the mother grebe rears her brood while sailing the waters. When leaving the nest, she covers her eggs. When the young are placed on the ground, they use their wings as fore feet, as though trying to imitate the quadrupeds.

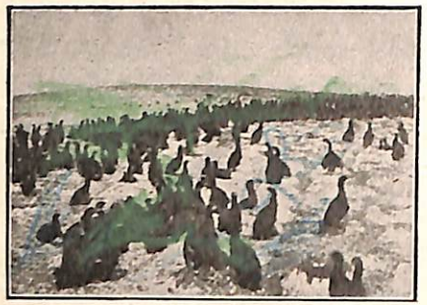
The *loon* and *penguin* are more fully water birds than any we have before mentioned.

Loons can not fly from the land; they have to start from the water. When on the land, they stand almost straight up, because their legs are set so far back.

The *penguin* of the Antarctic seas is more closely confined to the water than is the loon. Its wings are without feathers, and are used in swimming.

The *auks* are much like the penguin. They have short wings, heavy bodies, large heads, and close-fitting plumage. They are excellent swimmers and divers. They

live in the northern regions, and very seldom leave the water, except during the breeding season. They climb upon the rocks along the shore, and lay but a single egg, making no nest. They feed wholly on fish. The *great auk*, about three feet high when standing, is now thought to be extinct. It was not able to fly.



PENGUINS ON A SMALL ISLAND IN MAGELLAN STRAIT

The *albatross* and *petrel* are still other members of the swimming family.

**Questions**

1. What are the main points of difference between the scratchers and the swimmers?
2. What is the origin of our domestic duck?
3. Tell of the nesting habit of the wood duck.
4. Describe the migratory habit of the Canada goose.
5. Name three kinds of swan, and describe their plumage.
6. In what way does the duck manifest cunning?
7. How do geese and swans make a show of self-defense?
8. How did geese outwit the water rats that destroyed their eggs?
9. Describe the loon and the penguin.
10. What other swimmers are left for future study?

**Note Book Requirements**

1. On pages 81 and 82 write a brief story about the auk and the grebe.
2. Draw your favorite swimming bird, and color it. Draw its nest and eggs.



# Lesson LXXVII

## *The Wading Family*

Yea, the stork in the heaven knoweth her appointed times; and the turtle [dove] and the crane and the swallow observe the time of their coming; but My people know not the judgment of the Lord. Jer. 8: 7.

Now we come to a family of birds whose members do not live altogether on either the dry land or the water. They choose to live on the shores of lakes and streams, and on marshy or swampy ground. You see at once that their long legs and long bills admirably fit these birds for the life they live.

All the waders are wild birds, and do not seem to be attracted to the homes of man, with the exception of the stork, which in Holland builds its nest on the house-top or chimney.

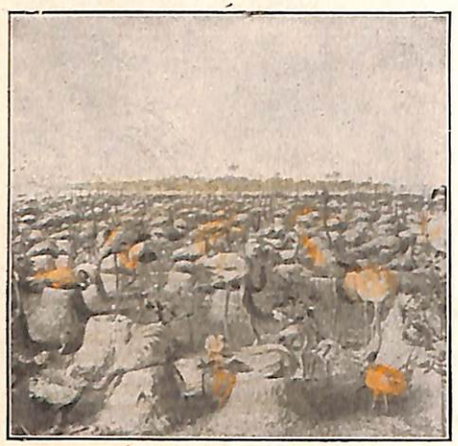
The *coot* is the little mud hen that is so common in the marshes. Its foot is not webbed like the duck, but lobed, having a flap on each side of the toes. This bird, with the stork, crane, and heron, can usually be seen in our zoölogical gardens.

One of the largest and most beautiful of the waders is the *Florida flamingo*. It has very long legs, and a very long neck. Its plumage is of scarlet color.

This bird has webbed feet, so that it can swim as well as wade. Its webbed feet also help it in walking on the water-covered mud. Its extremely long neck enables the flamingo to put its head down into the water, and turn it around, feeding with its bill upside down. Its

food consists of small fish, polliwogs, frogs, water snails, and water insects.

The flamingo does not like the bright glare of the sun, hence stays most of the time in the shade. It is owl-like; for it is about quite a little during the night.



FLAMINGOES

This bird travels in flocks, flying low over the water, but very high over the land. When flying, its long neck is stretched out, while its long legs are folded like a carpenter's measuring rule, and nearly hidden by its feathers. In flying, flamingoes flap their wings, then sail.

The nest of the flamingo consists of a little mound of earth, hollowed out at the top for the eggs. The female, in sitting on the nest, seems to have no difficulty in folding up her long legs.

The *crane* is another large wader. It is either white or brown in color. Cranes are very playful in their wild homes. They have been seen jumping, bowing, dancing, and flapping their wings, in a most amusing manner.

The large *whooping crane* has a powerful voice, which sounds like a loud whoop. Its large windpipe is two and one half feet long, and coiled up like a music horn. With this instrument, it produces the loud whooping sound,



which can be heard for miles. The whoop can be heard when the bird is too high in the air to be seen.

The *curlew* resembles the snipe, of which we have previously learned. It has a longer bill, slightly curved downward, and very sensitive at the end. It lives inland, but frequently visits the shores to gather its food between the tides. Its food consists of snails, worms, frogs, insects, and other small creatures which it finds in the sand and mud.

The curlew breeds away from the water. It takes no pains in building its nest. The four brownish green eggs are laid on the ground, with a few sticks carelessly placed about, so that the eggs and nest are not easily found. If you should come across a nest with the curlew sitting on the eggs, the bird would run for a way, then squat on the ground, stretching out its neck to escape observation. Its drab color would make it look as if it were only a stick on the ground.

It would be interesting to study the sandpiper, the plover, the woodcock, and other waders, that, like the snipe, have shorter legs, and live about shallow waters; but these we must leave until another time.

Many birds, as the duck, goose, stork, and crane, migrate every year. They live in the northern climes during the summer, laying their eggs and rearing their broods; but when cold, frosty weather comes on, warning them of the approach of winter, they go in flocks to the south, seeking a warmer climate. In doing this, they are obeying the instincts given them by their Creator; and the prophet Jeremiah refers to the stork and crane as

showing more wisdom and judgment than man, who has power given to him to reason.

Another lesson that the stork teaches us is, to be kind to those who are old and afflicted. This bird always cares very tenderly for its father and mother when they grow old and feeble. It is said that when the storks go together on a long journey, the old birds sometimes become tired, and then they are allowed to rest their heads upon the backs of the strong young birds, and sometimes are even carried on the backs of the younger birds. If any of them are ill, their friends bring them food and care for them. When tempted to be unkind to the aged or afflicted, let us think of the lesson that the stork teaches us.

**Questions**

1. Compare a wading bird and a swimming bird.
2. Describe the coot, or mud hen.
3. Where does the flamingo live? Describe its structure, flight, and nest.
4. Mention some of the waders having short legs, and tell where they live.
5. What are some of the waders that migrate?
6. Name other birds that migrate.
7. What lesson did the prophet Jeremiah draw from this example of bird instinct? Jer. 8:7.

**Note Book Requirement**

Write a story about the curlew and the flamingo for pages 82 and 83 of the Note Book.



# Lesson LXXVIII

## *The Plundering Family*

Doth the eagle mount up at thy command, and make her nest on high? Job 39:27.

The plundering family is divided into two classes of birds. In the first class are those plundering birds that fly by day, as the hawk, eagle, and vulture. In the second class are those that fly by night, the owl being the only example. But there are about two hundred kinds of owls.

THE AMERICAN BARN OWL

These are sometimes spoken of as "feathered cats"; and it is true that the owl might be thought to look somewhat like the cat, and has some of the same habits. It has a pussy face, and large, brassy, cat eyes, set square in the front of the head. It prowls about at night, and steals upon its prey by a quick, fluffy, still swoop.

The owls are flesh-eating birds, the young owls living mostly on insects. At night they visit the roosting places of the domestic fowls, and, seizing a chicken, carry it away in their strong, hooked claws. Some owls catch fish. They also catch mice, rats, and squirrels.

While owls do some damage in destroying the domestic fowls, yet they far more than pay for their board by rid-

ding the grain and cornfields of many destructive pests. In this they save millions of dollars to the farmers every year.

Owls generally seize their prey with their talons, and not with the beak. They use the beak in tearing the flesh into pieces. But if the animal is not too large, they prefer to swallow it whole, and this they can do with one gulp.

The *great horned owl* usually has a white collar about its neck. This bird is very large, and nearly two feet in length; and it is strong and courageous. It lives in all parts of North America. It usually builds its nest in hollow trees, and in crevices of rocks.

The *little horned owl* is called by different names,— American screech owl, red owl, and mottle owl. This bird wears out three suits of feathers every year, and each is of a different color — one very plain, another a mottled gray, and the third a tawny red. For many years, this owl was thought by all to be three different owls; but after a while somebody watched one closely enough and long enough to see him change his suit three times, and then it was clear that he had been fooling people.

Besides the great horned and the little horned owls, we have two more that are quite common — the *barn owl* and the *snowy owl*. Why, do you think, are they so named? The former is fifteen inches long, and the latter two feet.

You should study the birds in your neighborhood, and make a list of the scratchers, swimmers, waders, and plunderers. It may be that you will find some that are not mentioned in the lessons.



**Questions**

1. Into what two classes are the plundering family divided? Why is it so classified?
2. Give examples of each class.
3. By what other name are owls called? Why?
4. What is the food of the owls? How and when do they secure it?
5. Of what value is the owl to the farmer?
6. How does the owl seize its prey? How does it eat?
7. Describe the great horned owl.
8. Describe the little horned owl. How well did it for some time succeed in deceiving every one?
9. Name two other common owls.
10. What plunderers live in your neighborhood?

**Note Book Requirement**

Write on page 84 a story of your acquaintance with a plunderer that lives in your neighborhood.

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## Lesson LXXIX

*Birds as Friends*

Most of the birds are man's friends. Sometimes when we see them out in the garden eating the lettuce, or on the ripened shocks of wheat and corn shelling out the grain, or in the orchard helping themselves to the ripened fruit, we hear it said, "O, what pests the birds are!" But no; the birds are the friends of man. What little they take from garden, field, and orchard, we can well afford to let them have for what they do for us in return.

CUCKOO AND NEST

Did you know that without the birds there would be but little for the farmer to gather from the garden, little from the field, and still less from the orchard? The truth is that the birds are busily at work all spring and summer aiding the farmer, that he may not be disappointed when the time of harvest shall come. Many either do not know or do not appreciate the real value of the birds; else why do they treat them cruelly by throwing stones or shooting at them?

Let us notice a few of our common birds, and see what service they render us.

There are birds that live entirely upon insects. The *black-billed cuckoo* is one of these. He asks for no other diet. However, a mulberry tree or two about your home would make it more inviting for him. He would not eat the mulberries; but the abundant insects on the tree would be a temptation that he could not resist.

What a work the *wren* does in clearing

WRENS AND THEIR YOUNG



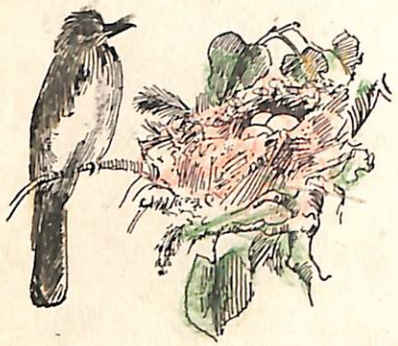
the orchard from caterpillars, beetles, bugs, ants, and gypsy moths! This little bird helps to destroy the cutworm, so destructive to the vegetables in the garden. And then it does not forget to do its part to save the grass of the meadow and the grain of the field from the ravages of the locust and the grasshopper. The house wren does not ask you to plant it a tree; but it would appreciate very much if you would build it a little house and give free rent, for the work it does in your garden.

ORIOLES AT HOME

MEADOW LARK AND HER HOME

The *oriole* and the *meadow lark* live largely on insects, although they sometimes eat vegetable food. This food consists of weed seed, which the farmer prefers to have eaten up; for if left to grow, it will certainly give him extra work to do. The meadow lark does not ask that you plant a tree for his sake; but the oriole is known to be fond of the black cherry, mul-

berry, and Juneberry trees. If you will plant these wild fruit trees about your house, then he will let your cultivated fruit alone; for he likes wild fruit better.

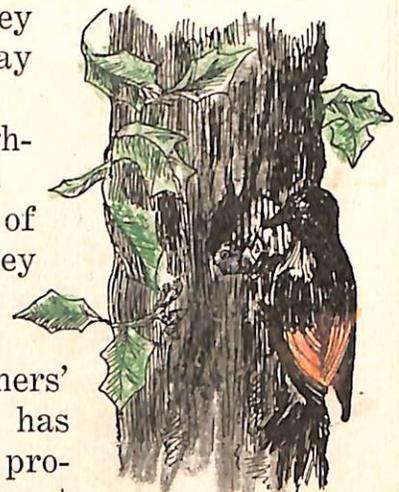


KINGBIRD

The *kingbird* and the *downy* woodpecker live largely on insects, but they are fond of some fruit in its season. Like the oriole, however, they prefer wild fruit.

The *robin* and the *bluebird* are our friends. About one half of the robin's diet consists of insects, and three fourths of the bluebird's is made up of the same thing. These two birds are widely known. They are very harmless, but will not stay long where they are illtreated.

Watch the birds of your neighborhood, and see them busily at work day by day. Make a list of their names, and the insects they destroy. Notice also their vegetable diet. The birds are sometimes forced to take of the farmers' fruits and grains, because man has cut down the forest trees which provided them with food, and has not planted others for them. If we treat the birds kindly, they will fully repay us. When the cold winter weather comes on, and their table is bare,



DOWNY WOODPECKER AT HOME



we can afford to share with them at least the crumbs from our cupboards.

If we succeed in making them feel at home, they will gladden us with their sweet songs, and teach us precious lessons of our heavenly Father.

ROBINS

**Spell and define**

| | |
|---|---|
| rob′ in | cuck′ oo |
| o′ ri ole | blue′ bird |
| wren | wood′ peck er |
| king′ bird | mead′ ow lark |

**Questions**

1. Name the birds mentioned in this lesson that are man's friends.
2. Why have they sometimes been regarded as his enemies?
3. What insects do these birds destroy?
4. Which of the eight birds eat mostly fruit? Which eat weed seeds?
5. Which one eats no vegetable food? Which one eats scarcely any?
6. What does this bird eat?
7. What trees, if planted about the house, would attract the birds? Why?
8. What has man done that has forced the birds to enter his garden, orchard, and field, and eat the products of his toil?

BLUEBIRD AND NEST

## *Table Showing Food of Bird Friends*

| NAME OF BIRD | Per cent Animal Food | Per cent Vegetable Food | Animal Pests Eaten | Vegetables Eaten | Desirable Trees to Set |
|---|---|---|---|---|---|
| Robin ..... | 50 | 50 | Caterpillars, grasshoppers, gypsy moths, cutworms. | Wild fruit, cultivated fruit. | Chokecherry, blackberry, Juneberry, juniper, mulberry. |
| Bluebird ..... | 75 | 25 | Caterpillars, beetles, bugs, grasshoppers, ants, gypsy moths. | Wild fruit, cultivated fruit. | Chokecherry, elderberry, mountain ash, cedar, juniper, mulberry. |
| House Wren ..... | 98 | 2 | Caterpillars, beetles, bugs, grasshoppers, ants, gypsy moths, cutworms. | | |
| Oriole ..... | 84 | 16 | Same as house wren and tent caterpillars besides. | Weed seeds. | Black cherry, mulberry, Juneberry, blackberry. |
| Meadow Lark ..... | 72 | 28 | Same as house wren. | Weed seeds. | |
| Kingbird ..... | 90 | 10 | Same as house wren and cankerworms besides. | | Black cherry, mulberry, barberry, wild grape, blueberry, pokeberry, Virginia creeper. |
| Black-billed Cuckoo | 100 | | Caterpillars, beetles, bugs, grasshoppers, spiders, millepeds, gypsy moths, potato beetles, tent caterpillars. | | Mulberry. |
| Downy Woodpecker. | 75 | 25 | Same as house wren. | | Juneberry, Virginia creeper, dogwood, strawberry, pokeberry. |



# Lesson LXXX

## *Bird Enemies*

Birds have many enemies. Even some of their own kin are their worst enemies. The larger birds take advantage of the smaller and weaker ones, and might justly be called bird cannibals. Among these cannibal birds you

THE BLUE JAY

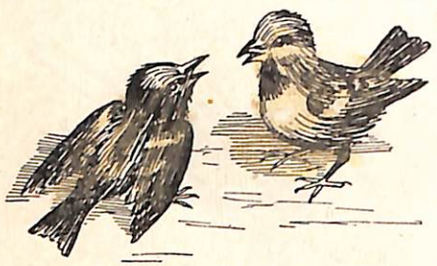
will find the hawk and the owl, which, perhaps, are the most notorious.

Some of the smaller birds, while they are not large enough and strong enough to take the life of their kindred, yet are so hateful and greedy that they make miserable the lives of the less quarrelsome and more desirable birds of our neighborhood.

These persecuted birds are constantly picked upon, their food is snatched away from them, their nests are

disturbed, and in every way they are made to feel that their presence is not wanted.

The blue jay is one of these irritable, saucy birds. It seems to be unhappy itself, and it does all that it can do to make the birds about it feel miserable. The blue jay is a thief. It eats the eggs of other birds, and breaks up their nests. It quarrels with every bird that comes along. What do you think of such a bird?



ENGLISH SPARROWS

Perhaps a more noted disturber of bird peace than the blue jay, is the English sparrow. Indeed, for its size, this impudent bird is the most notorious intruder known.

The English sparrow was brought to the United States from England in the year 1852. It was brought over to kill the cankerworm, which was so destructive at that time; but the sparrow is very largely a vegetarian, and therefore has not been so useful in destroying insects as was expected. Instead of attacking insects that are harmful to vegetation, he himself attacks gardens, orchards, vineyards, and grainfields in a most destructive manner. More unfortunate yet, he robs the native birds, breaks up their nests, and devours their eggs. The robins, bluebirds, wrens, tree swallows, song sparrows, and others are all insulted thus by this little "ruffian in feathers," and driven away from the cities and villages. Hence instead of having our homes surrounded by the inoffensive



and musical birds, we have the "creech-creech" of this plunderer.

English sparrows multiply very rapidly, five or six broods being hatched in a single season. In a little over half a century, they have spread throughout the country,

GROUP OF EGRETS WHOSE BEAUTIFUL PLUMAGE IS MUCH PRIZED

being especially fond of living in villages and cities. This is perhaps because in these places they are not so liable to be attacked by owls and hawks as elsewhere. If the sparrow race should go on increasing for ten years as it has for the last fifty years, there would be in the United States a nation of two hundred and seventy-five billion

(275,000,000,000) of these troublesome birds. Farmers and lovers of song birds are doing all they can to stop the increase of these robber birds.

Again, great numbers of our song birds are killed in heavy storms; and many die in times of drought. The destruction of their food supplies, and the clearing away of the trees, often bring the birds to want. If shade trees and places of shelter are taken from them, how can we expect the birds to get along? It will pay us to protect them in every possible way, giving them food and shelter, and doing all that we can to shield their nests and little ones from enemies of every kind. Such enemies as the cat, rat, weasel, fox, and opossum are far more excusable than is man, whom the Creator made ruler over all the lower creatures, intending this rule to be exercised in love.

Men who destroy birds for their beautiful plumage, are not more guilty than are the women who support this heartless practice. By refusing to wear for adorning that which costs the life and happiness of God's beautiful creatures, we are helping to put an end to this wicked traffic, and can be sure that our heavenly Father, who sees and cares for them, will protect and care for us.

**Questions**

1. Name two cannibal birds. What birds do they devour?
2. What two small birds are disturbers of bird peace? Describe the disposition and cruel work of the blue jay.
3. Give the history of the introduction of English sparrows into the United States.



4. How rapidly are they increasing? At this rate, what will be their number ten years from now?
5. Where does the English sparrow prefer to live? Why?
6. How is it everywhere regarded? What kind of disposition does it have?
7. What is its diet? How does it differ from the robin, bluebird, and oriole?
8. Name other enemies of the birds. Who do you think is their worst enemy?
9. In what way are women responsible for the destruction of birds? How can they help to check this evil?
10. What relation should man sustain to the animal creation?

**Requirement**

Make a list of the bird enemies in your neighborhood.

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## Lesson LXXXI

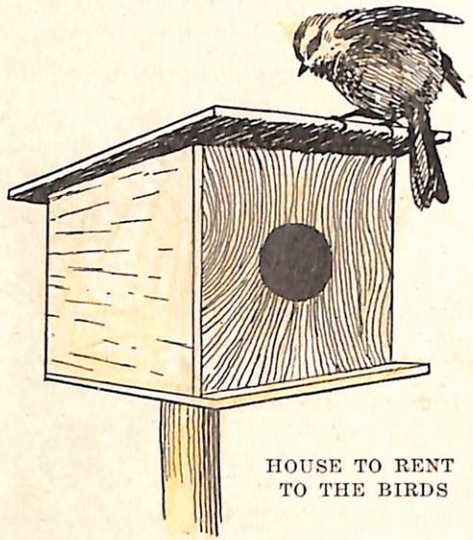
### *God's Care for the Birds*

**Consider the ravens: for they neither sow nor reap; which neither have storehouse nor barn; and God feedeth them: how much more are ye better than the fowls? Luke 12:24.**

God not only created the birds, but He cares for them day by day. Not even a sparrow falls to the ground without His noticing it. He made the birds to be a delight to man in the helpful service they could perform and in the songs they would sing.

The birds, as they flit about from limb to limb and from tree to tree, appear contented and happy. They do not seem to be worrying as to where they are going

to get the next meal, or where they will sleep overnight. They neither sow nor reap, they do not gather into storehouses or barns; yet, says Christ, "your heavenly Father feedeth them." Then He adds, "How much more are ye better than the fowls?" And as we are of much more value than the birds, there is no question but that we shall be provided with all the things we need.



HOUSE TO RENT TO THE BIRDS

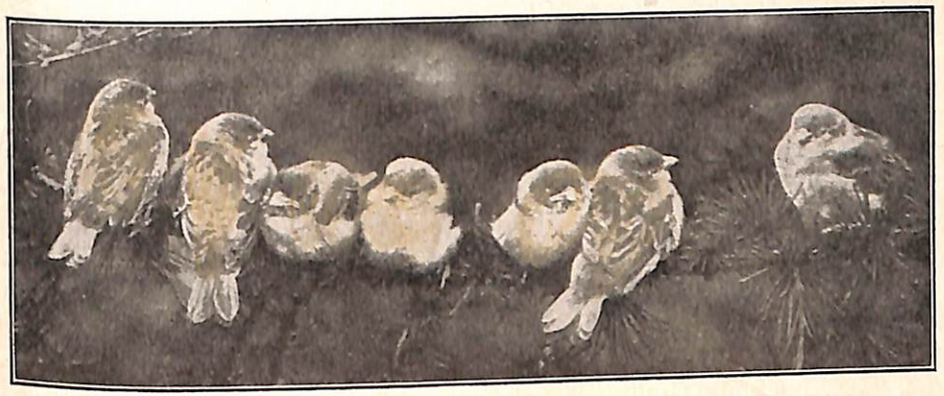
But God does not bring food to the birds; they go cheerfully about, picking it up wherever He has placed it for them. Likewise man has something to do. He can not sit down in idleness and expect God to feed him. As he has greater intelligence and greater strength than the birds have, God expects more from him than from them. They have not the wisdom and power to sow and to reap; but man has. Hence, while the birds only gather what God provides, God and man *work together* in providing our necessary food. Man does the sowing and gathering, but it is God that makes the seed grow and yield a harvest.

Our heavenly Father will just as certainly provide food for us as for the birds. Sometimes the crop is short; but it is no more so for man than for the birds, therefore man has no more cause for worry than have they. If



there is a lack, God will supply it. David says that God gives food to the young ravens when they cry.

God not only created the birds and feeds them, but He uses them to do His bidding. A remarkable instance is recorded in the Bible. When a famine was upon the land, God commanded the ravens to feed Elijah; and faithfully, morning and evening, they took food to him. In this case, man seemed dependent on the birds for his



A ROW OF SPARROWS

daily food. But who provided for the birds? Both man and birds were dependent on God; yet no more then than now.

The Creator knows all the birds; and equally well He knows all about us. Let us learn from the birds to live a trustful, cheerful, contented life.

Birds are mentioned many times in the Scriptures to teach some lesson. What lesson is to be learned from the following birds? —

1. The crane, stork, and swallow. Jer. 8: 7.

2. The hawk. Job 39: 26.
3. The eagle. Deut. 32: 11, 12; Ps. 103: 5.
4. The hen. Matt. 23: 37; Luke 13: 34.
5. The ostrich and peacock. Job 39: 13, 14.

**Questions**

1. How closely does God take notice of the birds? Give text.
2. For what purpose were the birds created?
3. What traits do the birds manifest as they flit and hop about?
4. Who feeds the birds? What lesson does Christ teach us from the birds? Give texts.
5. Do the birds have anything to do in securing food? Does man?
6. Which has most to do? Why?
7. Is the food of one any more certain than that of the other? Why?
8. Does God note the bird's cry of distress? Job 38: 41; Ps. 147: 9.
9. Give an incident in the Bible showing that God controls the birds.
10. How wide is God's knowledge of the birds? Ps. 50: 11.
11. With what birds of your neighborhood are you best acquainted?
12. What is your favorite bird? Why?
13. Where does each of these birds build its nest? Why?
14. Which of these lay the largest egg? Which the smallest? Which the largest number of eggs?
15. Which bird of your acquaintance is the most skillful builder?
16. Which bird shows the most affection? Which the least?
17. Which birds are the easiest to tame?
18. Of what bird have you learned the most lessons?

# CHAPTER X

# THE LAND ANIMALS

*(Scripture Basis, Gen. 1: 24, 25)*

*"And God said, Let the earth bring forth . . . cattle, and creeping thing, and beast."*

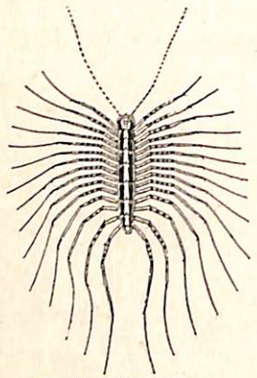
## Lesson LXXXII

### *Creeping Things*

**In that day I will make a covenant with the . . . creeping things of the ground. Hosea 2:18.**

The psalmist speaks of the creeping things in the sea as being innumerable; and those on the dry land are likewise beyond number. The creeping things include more than the milleped, centiped, scorpion, tarantula, and spider. They include all the insects, both those that have wings and those that do not; for Moses spoke of "every

creeping thing that *flieth*." The creeping things that fly are called insects. In the Bible, even such creatures as the mole, weasel, and mouse, are considered as creeping things.

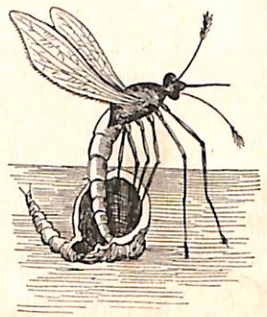


THE CENTIPED

But there is a mighty host of creeping creatures in the insect family alone. We see them wherever we go, on the right hand and on the left, above and below.

Many insects live in the water for a time, and then spend the remainder of life on the land. Some spend years in the water, and but a short time on the land. Some stay in the water during the day, and at night fly about seeking for food.

The insect family is very interesting to study; and many secrets you can learn from these little creepers. Do not look upon the bugs and caterpillars with contempt and disgust, and brush them aside or stamp them under your feet as if they were not worth your notice. The wise man did not do this. No; he watched and studied them, and learned many valuable lessons from them. He advises us to consider their ways and be wise.



GNAT LEAVING PUPA CASE

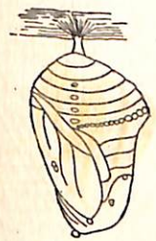
Not all that are called insects are such in truth. The centiped, milleped, tarantula, scorpion, and spider, are not true insects. There are two tests to be applied, both of which must



exactly fit the creeper if we rightly call it an insect. First, the body of an insect is divided into three distinct parts,— the head, the thorax (chest), and the abdomen (stomach). Secondly, there is in an insect a constriction — that is, a narrowing — between the head and the thorax, and between the thorax and the abdomen, so distinct that you can plainly see where each part begins and ends. Sometimes the connecting portion is only a slender thread. The insect creeper must have also six legs, no more and no less. The three pairs of legs are all connected with the thorax. These two tests any boy or girl can apply to the full-grown insect with absolute certainty.

LARVA

Most insects undergo three stages of growth or development. On this account, they are not always recognized. Sometimes they are called worms. In fact, most of the creepers that are called worms are insects. The worms do not belong to the insect family at all. Worms are somewhat scarce. The earthworm, tapeworm, and leech are examples of true worms. Now, why is it that people do not call these things by their right names? — It is because of not having learned the three stages of insect development. Here they are:—



PUPA

(1) *Larva Stage.*—The larva develops from the egg; and during this period of life, the insect is by mistake called a worm. At this stage it is most destructive, for it devours greedily the green foliage of plants.

(2) *Pupa*, or *Chrysalis Stage.*— After the larva has

eaten to the full, it makes for itself a little case to protect it from its enemies and the moisture and cold, and goes into the resting stage. The insect in this stage is called a pupa, or chrysalis. The little case in which it hides for its long sleep is often termed a *cocoon*.

(3) The *Imago*, or *Adult Stage*.— During the period of sleep, a change goes on in the body; and when the

IMAGO OF BUTTERFLY

insect comes out of the cocoon, it is in the perfect image of what it will be when fully grown.

There are some insects that do not go through these three stages; but nearly all develop from the egg. The study of insect development is very interesting, and can be carried on with very little time and effort. Do not kill insects except when it is necessary for your protection, or for the protection of crops.

By collecting the eggs and cocoons, you can see the insects develop. In autumn the cabbage larvæ will be



good for study, as they pass rapidly through the three stages. The collected cocoons can be fastened to a card and hung up in a room. When the creatures inside begin to awake, take the card down and carefully watch the awakening process. A small box covered with a pane of glass will be useful in studying the insects and feeding them. A small aquarium is necessary for the study of insects that live a portion of the time in the water. A glass jar is better than nothing.

**Spell and define**

| | | | |
|---|---|---|---|
| in′ sect | i ma′ go | co coon′ | tho′ rax |
| pu′ pa | chrys′ a lis | a qua′ ri um | ab do′ men |
| lar′ va | con stric′ tion | worm | cat′ er pil lar |

**Questions**

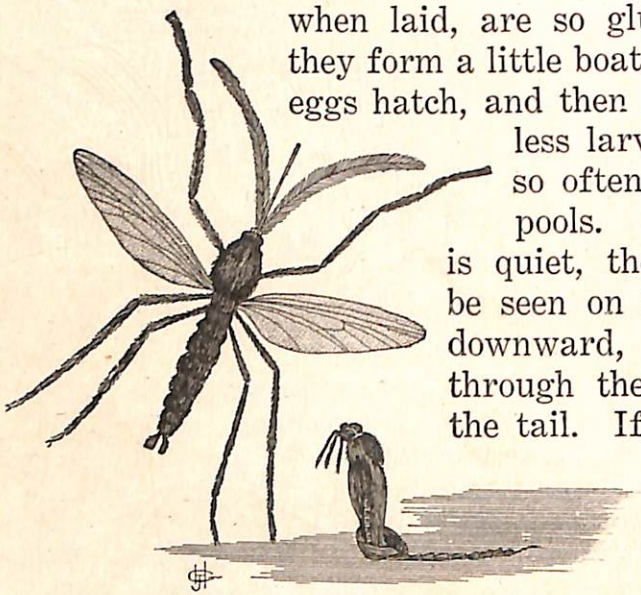
1. What animals are usually considered as creepers?
2. Are insects creepers?
3. How do insects differ from all other creepers?
4. Are insects abundant? Where do they live?
5. From what are most insects developed? How many stages of development do most insects pass through?
6. Name these stages, and explain each.
7. What notable Bible character studied the insects? What benefit did he derive from this study?
8. In the fall of the year, what material may be collected for study?
9. What is needed to aid in the study of living insects?
10. When did the Lord make a covenant with the creeping things? What was the covenant? Joel 2:25, 26; Hosea 2:18.

# Lesson LXXXIII

## *The Two-Wing Family*

He spake, and there came divers sorts of flies, and lice in all their coasts. Ps. 105: 31.

The mosquito is a member of the two-wing family. It spends the first part of its life in water. The eggs, when laid, are so glued together that they form a little boat. In a week these eggs hatch, and then appear the countless larvæ, or "wigglers," so often seen in stagnant pools. When the water is quiet, these wigglers may be seen on its surface, heads downward, sucking in air through the hairy tube near the tail. If the water is disturbed, they instantly wiggle to the bottom. After ten or fifteen days they change from the larva form to the pupa form. The pupa sheds its skin several times, and tumbles about in the water by means of two paddles; but after ten days of this life the case bursts open along the back and forms a boat. The mosquito sticks out its head, and one pair of legs after another, until all are free; then it balances

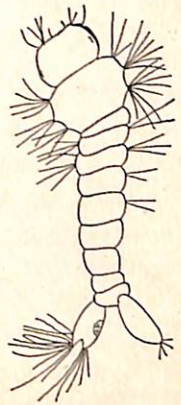


MOSQUITO LEAVING PUPA CASE



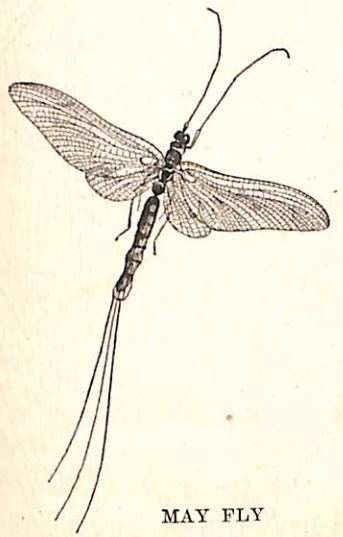
itself on its tail, waiting for its legs to grow strong and its wings to dry.

This is a critical period in the life of the mosquito, for it is liable to be shipwrecked by a sudden gust of wind or a drop of water. But if no harm overtakes the insect, it spreads its wings at the right moment, and flies away. Its food consists of the blood of animals and the juices of plants. Only the females bite; the males, which live but a short time, remain in the woods and marshes.



MOSQUITO WIGGLER (LARVA)

The mosquito has two feelers, and a beak, which is divided into six parts. First is the upper lip, which is grooved so as to receive the tongue; then come the large jaws, which might properly be called fangs, since they contain poison; next to these is a pair of small jaws, barbed at the end, which work back and forth like saws. When the mosquito bites, all these parts are pressed into the upper lip, and form an awl-like beak.



MAY FLY

The May fly, or day fly — for in its fully developed state it lives only one day — is another two-winged insect. Although it lives about three years in the water, it lives only one day on the land — just long enough to deposit its eggs.

The gnat is also a "two-wing," and resembles very much the mosquito, but it is considerably smaller.

**Questions**

1. To what family of insects does the mosquito belong?
2. Where does it spend the first part of its life? Where are the eggs deposited?
3. Describe the larva stage. What is the mosquito called during this stage?
4. Describe the pupa stage. How long does the larva stage last? The pupa stage?
5. How does the mosquito emerge from its pupa case? Why is this a critical event?
6. What is the food of the mosquito? Where does the male live?
7. Give a description of the beak of the mosquito.
8. Name two other members of the two-wing family, and tell what you know of each.
9. Do mosquitoes have anything to do with disease? Find out what you can about this.
10. Does God control the flies?

**Note Book Requirement**

On page 85 make drawings of the mosquito in its three stages, and write a brief history of its life.

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## Lesson LXXXIV

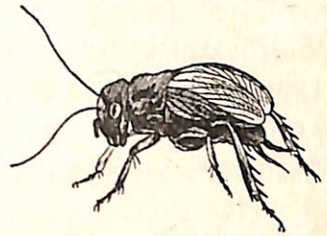
### *The Straight-Wing Family*

**He spake, and the locusts came, and caterpillars, and that without number, and did eat up all the herbs in their land, and devoured the fruit of their ground. Ps. 105: 34, 35.**

The straight-wing family is a very large one, the grasshopper and the locust being the most common members. Crickets and katydids are the most talented musicians of this family.



The *house cricket*, as its name indicates, lives in human dwellings. It is of a grayish brown color. Often when things are quiet about the home, you will hear the clear, shrill note of the cricket. This musician does not tire of singing; or, rather, it does not tire of playing; for the sound is not produced in the mouth, but on a musical instrument that it never fails to carry along. The wings are drawn across each other, and the vibration of the moving wings produces the tone. It is on the principle of the fiddle and the bow. The music of the cricket is furnished by the male. It loves best to play at dusk when the family gather about the hearthstone; and it is not easily disturbed even by loud commotion and laughing.



CRICKET

Living in the house where it is warm, house crickets seem to have a thirsty habit. Many times they are found drowned in dishes of water or milk. They seek for whatever is moist, and often spoil wet clothing by gnawing holes in it.

They have voracious appetites, eating not only crumbs, but all kinds of kitchen sweepings.

Closely related to the house cricket is the *black cricket*, which will live in the home if allowed to do so, but it stays for the most part in the field. While taking an evening ramble over the fields, we hear the cheerful music of the field cricket. It is very difficult to get a view of

one of these musicians; for the moment it hears the sound of a footstep, the music ceases, and the skilled player retires into its burrow until the passer-by is out of hearing.

Most people think that the cricket does not play its violin until autumn approaches. While this is true as far as the cricket bands and orchestras are concerned, yet the solo may be heard just as soon as the warm weather comes in spring.

The field cricket lives in a burrow, which is kept smooth and very clean. The female deposits her eggs in the ground, much as the grasshopper does. Field crickets feed on leaves, growing grass, and grain, or on the roots of these plants.

A cricket cage is easily made by placing fresh sod in a flowerpot, and over this a lantern globe pressed a little way into the dirt. Over the top of the globe, wire netting may be placed. Keep the sod damp, and a little shallow dish of water in the cage. To provide fresh food, sow clover, grass, or grain in flowerpots, and when it is two or three inches high, move the cricket to the new pastures.

KATYDID

*Katydid* is a much beloved musician. It is usually silent during the day, but musical throughout the night. Like the male cricket, the male katydid plays a violin;



but it plays a different tune. It seems to say in its music, "Katy did, Katy didn't." The female answers by a single sharp chirp, which is produced by a quick jerk of her wings.

Sometimes in autumn the katydid keeps the air resounding with its music both day and night. It climbs into tree tops as though trying to outdo its neighbor in entertaining its hearers.

The eggs are glued to the bark of twigs and branches of trees.

**Questions**

1. Which are the most common members of the straight-wing family?
2. Describe the house cricket. Where does it live?
3. How does it produce its music? When does it play?
4. Describe the black cricket. Where does it live?
5. How does it multiply?
6. What is the cricket's bill of fare?
7. Tell how to make a cricket cage. Make one.
8. Describe the katydid.
9. How does it rank as a musician? On what does it play? What does it play?
10. How does the female katydid respond to the music?
11. Where does the female katydid deposit her eggs? Compare with the grasshopper in this respect.
12. For what purpose did the Lord use locust armies anciently?

**Note Book Requirement**

On page 86 make a drawing of a cricket and some other member of the straight-wing family.

# Lesson LXXXV

## *The Half-Wing Family*

Many call *all* the insects that do not fly, either "bugs" or "worms"; but you have already learned that *none* of the insects are worms. However, a large number of insects *are* bugs. All the members of the half-wing family are bugs.

A bug has a long sucking tube, which is folded under the breast, between the legs, when not in use. This tube is used for sucking the juice from plants.

In this lesson we shall consider some small members of the half-wing family. As a rule they do not have wings, and might not be classed with their relatives about whom you have already studied — the cicada, the squash bug, and the giant water bug. But they have the sucking tube, and by this we know that they belong to the half-wing family, and are true bugs.

PLANT LOUSE

Plant lice are very common and very annoying insects. They may be found in garden, orchard, and field, sucking sap from plants, and thus destroying them. "Aphids" is another name for plant lice. Some of them live underground, and suck sap from the roots of plants, as does the *corn louse*. The *grape louse*, called *grape phylloxera*, lives on both the roots and the leaves.

Some of the aphids migrate from one plant to another. The *apple tree louse* migrates to the grasses for its summer vacation, and in the fall returns to the apple



tree, where it feeds for a time, then deposits its eggs. The *hop louse* feeds upon the plum in spring, then passes to the hop for the summer, returning to the plum in the fall.

One of the most common plant lice, and the easiest to study, is the *cherry aphid*. If you gather a few cherry twigs in October and keep them fresh by placing them in water, you may by careful observation, using a magnifying glass, see the lice lay their eggs in the angle between the bud and the twig. The eggs can be seen with the naked eye. They are oval, yellowish green bodies at first, but in a short time turn to shining black.

At any time during the winter, gather some cherry twigs that have eggs behind the buds. Take these twigs into a room at the time when the buds are about to burst in spring. The eggs will soon hatch into tiny, black lice. They will not have wings. These are females; and after growing about two weeks, they begin to give birth to living young, which are very small, but perfect in form. Each female gives birth to two or three a day. These newly born aphids also are females; and in a few days they bring forth young at the same rate.

Now, if we keep watch of the cherry trees, we will be surprised to see millions of these small creatures where but a few days before there was only a single one here and there. Test this rapid rate of increase by securing a single aphid on some food plant, and noting the increase from week to week. One mathematician has estimated that in five generations, which might require ten weeks, a single aphid could become the mother of nine and one half trillions (9,500,000,000,000) of young

aphids. If these were placed in single file, end to end, they would reach more than three hundred times around the earth. A single female has produced as high as twelve generations in one season. What a procession her young would make!

The last generation are winged aphids, and leave the cherry tree house for some other; but just what plant they visit is not known. Later this winged generation return, and deposit their eggs behind the buds on the cherry tree. This completes the history of the insect.

Plant lice should be destroyed before they destroy the trees. Nothing in nature shows more clearly what an infinite power for harm a little thing may be.

There are other members of the half-wing family that are not satisfied with the diet of the aphid. Instead of sucking the juice from plants, they suck the blood of man, birds, and beasts, and hence are held in great disrepute. Any one who goes in the company of these lice, bedbugs, and fleas, is in danger of losing his reputation.

**Questions**

1. To what family do all bugs belong?
2. What are plant lice, and where may they be found?
3. Name two kinds of aphids.
4. Tell of the migration of aphids.
5. Describe the cherry aphid, and tell how it multiplies.
6. How do the last generation of cherry aphids for each season differ from earlier ones?
7. What lesson may we learn from these tiny pests?



# Lesson LXXXVI

*The Sheath-Wing Family*

Many of the insects that are often called bugs, you must remember to call beetles, for a beetle is not a bug. It has no tube for sucking up the juices of plants; but instead, it is provided with two or three sets of horny jaws which it uses in cutting and biting its food.

The sheath wings, which are composed of a horny substance, were made for protection, and not for flight. Under these the beetle neatly folds its wings, which are thus protected from the wet, and from being torn and bruised by its enemies.

There are thousands of different kinds of beetles. You will have no difficulty in finding specimens for study. When a log, or box, or any object that has been on the ground for some time, is turned over, under it will generally be found two or three different kinds of beetles, which will be greatly surprised, and, if not too dazed, will try to make their escape. You can study these insects very well by placing them in a tumbler.

The beetles are the giant family among the insects. You can test their strength by making a hollow saddle out of putty. Place this on the back of a stout-looking beetle in such a way as not to interfere with his legs. In this saddle place all the shot he can carry away with him. With delicate scales weigh the beetle, and then weigh the shot. If a man weighing one hundred fifty pounds were as strong as the beetle, in proportion to his weight, how much could he carry?

The aphids, or plant lice, of the previous lesson have an enemy which devours them in great numbers. It is the *lady beetle* — not ladybug, as it is usually called. This beetle is about the shape of a hemisphere. The upper, rounded surface is red, with black spots.

LADY BEETLE

A branch of cherry or apple covered with aphids is likely to show lady beetles in all stages of development. The yellow eggs in clusters will be seen in the midst of a swarm of plant lice. The black larvæ with red or yellow spots, and the adult beetle, will be found devouring the aphids. The pupæ may be found hanging to the leaves or twig by their tails. Sometimes the lady beetle comes into the house to pass the winter. It should not be treated as an unwelcome visitor. Let it find a home among your house plants, and it will prove itself worthy of your kindness. Lady beetles are the friends of man.

The *black blister beetle* is very common in the fall of the year. It has a narrow, oblong body, and is jet black in color. It is found on the flower clusters of golden-rod and ragweed, and sometimes on potato and tomato vines. The blister beetle should not be handled with the fingers; for it secretes from its abdomen a yellow fluid that will blister the skin.

The black blister beetle lays its eggs from July to October inclusive. These are deposited in masses of more than a hundred in shallow holes in the ground. The place selected is warm and sunny, such as the locust and the



grasshopper choose. The eggs are covered with a little earth, and left to hatch.

From the egg hatches an active larva, with good legs for running about. It first finds a cluster of locust or grasshopper eggs, and begins a feast that lasts for several days. During this feasting time, it molts, or sheds its skin, twice, and becomes a legless larva. After molting several times, it leaves the egg cluster, and burrows deeper into the soil. Now it is a pupa. Later it emerges from the ground an imago — a full-grown black blister beetle.

SNAP BUG

The *spring beetle*, commonly called the snap bug, is an interesting creature. It gets its name from its ability to spring upward when lying on its back. Its legs are so short that it could not turn over without this springing device. It consists of a spine, the point of which fits into a cavity behind it. This you will find on the breast between the bases of the first pair of legs. When upon its back, the insect folds its legs close to the body; and then, bending back its head and thorax, it draws the spine out of the cavity. Now it straightens its body suddenly, and presses the point of the spine against the sheath. This, acting as a spring, throws the insect upward, and it alights on its feet.

The *firefly beetle*, or lightning bug, as it is sometimes called, is one of the most interesting members of the sheath-wing family. In August this black beetle, with a yellowish or red border to its wings, may be seen on the golden-rod flower clusters. In the daytime it feeds

upon the pollen and helps to fertilize the flowers. At night it flits about, carrying its bright spark lantern with it.

The light is produced by phosphorescent matter contained in the abdomen. It can turn the light on and off, as we can an electric bulb. In the tropics, there are very large fireflies. The lantern fly of South America sometimes measures as much as five inches across the wings. These living lanterns furnish light in the homes of some of the inhabitants.

**Questions**

1. What is the difference between a beetle and a bug?
2. For what purpose are the sheath wings of a beetle?
3. Where may beetles be found for study and observation?
4. How do beetles compare with other insects as to strength?
5. Describe the lady beetle in its different stages.
6. In what respect is this insect of value to the farmer? To the home keeper?
7. How does the black blister beetle look? Where may it be found?
8. Tell of the development of the blister beetle.
9. Describe the spring beetle. Why is it so named? Locate and explain the spring.
10. What is the appearance of the firefly? Where does it stay during the day?
11. Locate and describe its spark lantern.

**Note Book Requirement**

On page 87 make drawings of the beetles mentioned in this lesson, or others if these can not be obtained.



# Lesson LXXXVII

## *The Scaly-Wing Family*

When spring has come, and the birds are singing, and the warm sun is flooding the earth, when the grass is growing, and the cows are feeding, and the yellow butter is gathering in the churn, then it is that the butterfly comes.

Flitting and dancing about, fluttering over the pools by the roadside, with a set of four bright yellow wings, may be seen our beautiful insect whose name was suggested by the butter in the churn. This yellow creature, called *colias*, has the honor of giving the name to the whole butterfly family, even though some of them are white, brown, or black, or of beautifully mixed colors.

MONARCH BUTTERFLY ON THISTLE

When the summer has fully come, the swallow-tailed butterflies appear in our temperate regions. One of these, which is quite common, wears a rich dress of yellow and black. Its family name is *papilio*.

When the butterfly visits the flowers, it is seeking its food, which consists of the sweet juices of the flowers. It has a long tubular tongue, which is rolled up when not in use. When extended, it reaches to the bottom of the flower.

The papilio lays its eggs on the leaves of plants that will furnish food for its young.

The young butterfly is called a *caterpillar* instead of a larva. It is usually very ugly in appearance, and sometimes its body is covered with long, stiff hairs. The caterpillar is a very greedy creature, eating, on the first day of its life, twice its own weight. At the end of a month it has eaten forty thousand times its weight.

In order to accommodate itself to this rapid growth, it changes its suit of clothes six times. The change is made by the skin's splitting down the back, the old coat being then cast off.

When the last change is made, the butterfly ceases to eat, and sheds not only its skin, but also the lining of its stomach, for which it has no further use, since it is about to go on a long fast.

Under its chin is a spinning machine, with which it spins a silken thread. One papilio fastens its tail to some object, and passes a thread about the middle of its body to hold it secure. Some hang by the tail. In this state the creature remains about two weeks, and is called a chrysalis instead of a pupa.

The chrysalis case is not a coffin; for on the inside a wonderful work is in progress. Feelers, tongue, legs, and beautiful wings are forming. The fat laid up by the greedy caterpillar, now keeps it alive and enables it to live without eating, in the same way that the camel's hump supports the life of that animal when it is without its customary food.

After a time, if the chrysalis escapes harm, the case



splits open, and out comes the imago, the perfect butterfly. It dries its wings, and flies away to lay eggs for another generation of butterflies.

**Questions**

1. What insect has the honor of naming the butterfly? Why?
2. What common butterfly has a yellow and black dress? Where does it live?
3. Why does the butterfly visit the flowers? Describe its tongue.
4. Where does the papilio lay its eggs? What is the larva of the butterfly called?
5. Describe the appearance of a caterpillar. How does it eat?
6. Explain its molting.
7. Describe a cocoon. How is it made?
8. What changes take place within it?
9. What lessons do you learn from the ugly caterpillar and the beautiful butterfly?

**Note Book Requirement**

On page 88 write the history of the papilio.

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## Lesson LXXXVIII

### *The Membranous-Wing Family*

The ants are a people not strong, yet they prepare their meat in the summer. Prov. 20: 25.

Solomon thus advises the lazy man to study the ant, and learn from it lessons of thrift and industry: "Go to the ant, thou sluggard; consider her ways, and be wise."

Let us study the ant, and learn the ways and habits

given it by the Creator. There are three classes of ants, — the queen, the drone, and the worker. Only the queens and the workers have wings. The upper wings are the larger, and are fastened to the lower ones.

The work of the queen is to lay the eggs; and the workers take care of them. It requires about one month for the eggs to hatch; and during the larva state the young are fed by the workers. After a short time, they change to the pupa state, remaining in this for five or six weeks. During all this time the workers act as nurses, looking carefully after the needs of the young insects.

LARVA, PUPA, AND EGGS OF ANT

You have seen the eggs many times when the nurses were carrying them about. They greatly resemble a kernel of boiled rice. Perhaps you have seen the ants carrying the eggs out of the nest and leaving them in the sunshine. After a few hours, they carry them back into the nest again. Why do they do this? — It is too cold down in the ground for the eggs to develop, so they are brought out that they may be warmed.

THE ANTS' STOREROOM

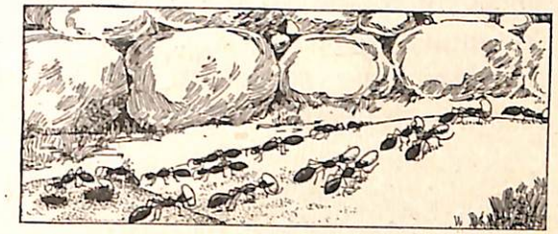
When the little ant is ready to begin its busy life in the world, the nurse bites off one end of the pupa case, and sets the captive free.

After some of the eggs are hatched, the nest is often overcrowded, so a part of the family take up quarters in some other suitable place. You have noticed, probably, a long line of ants leaving an ant-hill; some were carrying eggs, some carrying larvæ, and others the pupæ. They

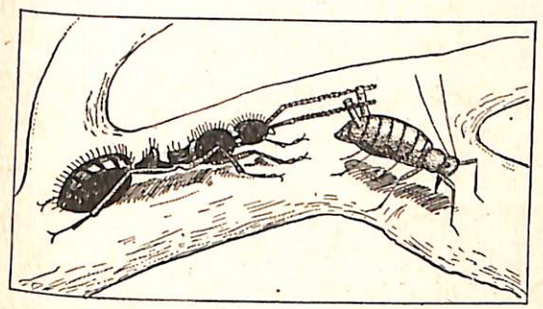


were moving. They generally select a warm, sunshiny day for going to their new home.

All the workers — and they are workers, indeed — take hold in earnest, turning the earth out of the hill, thus making hallways and galleries in which to live and care for their young. Their nest is usually situated near a tree, so that their cows may live on the sap contained in the roots. Why, do ants keep cows? — Yes; there is a plant louse that secretes a sweet juice called "honeydew," of which ants are very fond. In milking, the ant presses the body of the plant louse with the fore legs, and the honey exudes from the two glands. The ants treat their cows kindly, and take care of the young calves.



ANTS CARRYING THEIR BABIES



ANT MILKING ITS COW (GREATLY ENLARGED)

You have learned something about two members of the membranous-wing family, the honeybee and the ant; and, indeed, they are the wisest and most industrious of the whole family. Keep on studying them; but I want you to know that this is a very large family, and it will keep you busy to become acquainted

with these busy little people. There are the bumblebees, carpenter bees, digger bees, potter bees, cuckoo bees; and there are the near relatives of the honeybee — the wasps, the hornets, the yellow jackets, and many others. There are many different kinds of ants which are very much alike in their structure and habits. In all, there are over five thousand divisions of this large family of insects.

**Questions**

1. Into how many classes are the ants divided? Name them. Which have wings?
2. What does the queen do? What do the workers do?
3. How much time is required for the eggs to hatch?
4. How are the young fed during the larva period?
5. How long is the ant in the pupa state? During this time, how are the young cared for?
6. How do they emerge from the pupa state?
7. Describe moving day.
8. Describe their home making.
9. Describe their dairy.

**Note Book Requirement**

On page 89 write the life history of the ant.

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## Lesson LXXXIX

*The Duckbill*

There is a very odd-looking creature living in Australia called the duckbill. This animal seems to be a combination of beast, bird, reptile, and fish, as you will see from a description of it. The duckbill is about the



size of a rabbit or woodchuck. Its body is broad and flat, with four short legs. The feet end in five toes, which have sharp claws.

It has a fine coat of fur, which is dark brown above and nearly white beneath; and it has a ducklike bill. Its home is formed by making a long burrow, often forty or more feet in length, into the river bank. At the end of this burrow, it makes a nest of leaves and grass, in which it deposits its eggs. From these eggs the young are hatched.

THE DUCKBILL

This is certainly a birdlike animal! It has the bill of a bird, and rears its young from eggs; and yet it is a quadruped — a four-footed creature. It resembles the swimming birds in having webbed feet. The web membranes of the fore feet extend beyond the toes; and those of the hind feet, to the nails. These membranes can be folded up when the animal is burrowing or swimming.

It has a broad, flat tail, which serves as a rudder when swimming. It is a good diver, and feeds upon the worms and insects which it turns up with its bill, the same as the duck. Its internal organs are much like those of a bird. When standing upon its hind legs with its short fore legs drawn toward its breast, it very much resembles the penguin.

The duckbill is cleanly in its habits. It lies in its nest, rolled up like a ball, during the day; but at night

it leaves its nest, going in search of food. It can remain under water seven or eight minutes at a time. Unlike any other animal known, the mother emits her milk in the water. The milk being lighter than water, it rises to the surface, and is sucked up by the young duckbills.

The duckbill is capable of wonderful activities, which are surpassing strange when all combined in one animal. It can crawl like a tortoise, run like a badger, swim like a fish, dive like a duck, dig like a mole, and climb like a squirrel.

It is unlike any other animal that is in existence; and when early voyagers who visited Australia, first brought back reports of this curious creature, they were not believed.

Both the plants and the animals in Australia differ considerably from those usually seen in the Northern Hemisphere.

In the great diversity of plant and animal life all over the globe, we see an expression of the infinite wisdom and power of God, who made all these creatures and fitted them to live happily under the conditions that surround them. You should visit the zoölogical gardens, when you can, where wild and curious creatures of other countries as well as our own are kept at great expense, for the education and entertainment of all visitors.

**Questions**

1. Where is the home of the duckbill?
2. Of how many kinds of animals does this creature seem to be a combination?



3. Describe its body, legs, and feet. How large is the duckbill?
4. What is its color?
5. Tell of its home. How does it multiply?
6. In what particulars does it resemble a bird?
7. What is its food? How and when does it eat?
8. In what respect is it unlike all other known animals?
9. Give an account of the activities of the duckbill.
10. What is revealed in curious and varied forms of plant and animal life?

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## Lesson XC

*The Gnawing Animals*

The rabbit is an innocent creature, having no disposition to quarrel and fight. It has long ears, which enable it to hear very acutely. It builds its nest usually underground, making it of leaves, grass, and fur from its own body. It is a familiar type of a very large family of animals known as the gnawing family. Their teeth are so constructed as to enable them to gnaw the bark from trees and roots. The gnawing animals are very numerous, and are to be found almost everywhere, even on board the ships which navigate the seas. Mice, rats, squirrels, and beavers are familiar members of this family, and are very interesting to study.

Many persons suppose that the rabbit and the hare are the same creature; but this is not true. They resemble each other in many respects, still they are easily distinguished. The hare has longer ears and thighs than

the rabbit; its body is more slender, and its coat of fur is of a deeper fawn color. It lives in either hilly or level regions, forests or fields. It does not burrow in the ground, while the rabbit does. During the daytime the hare does not usually stir from its nest; but as soon as the sun begins to sink in the west, it goes forth to seek its food, which consists largely of roots, herbs, and leaves. It is especially fond of sage and parsley.

RABBITS

The rabbit lives in societies. It is not found on the open plain, but chooses its home where there are hillocks and woody banks. Like the hare, it goes forth in the evening to search for food.

The rabbit has many enemies; and in order to escape them, it takes refuge in its home beneath the ground. The burrow, which may be either straight or crooked, ends in a circular room, furnished with a bed, which consists of leaves and fur. On this bed the young are reared.

Every time the mother rabbit leaves her burrow, she carefully closes the entrance, so that no harm may come to her young children. In about twenty days they are able to provide for themselves, and are strong enough to do without the protection of their parents. They remain together, and soon make a burrow for themselves, where they live in common. The family generally numbers from four to eight.



In many countries rabbits and hares do a vast deal of damage to the farmers' crops. This is especially true in Australia. Even in California they are found in great numbers, and do much harm in gnawing the bark from different kinds of fruit trees. Rabbits are common pets in all lands. In many places, especially in the country districts of France, they are reared in large numbers, and sold at good prices.

The *beaver* is another member of the gnawing family. It was once abundant in North America, but it flees before civilization, and is fast becoming rare both in this country and in Europe. Its scaly tail and webbed feet enable it to swim with ease. It is a very intelligent creature, as shown in the building of its habitations.

If the place of building is by stagnant water, the beaver begins building on the bank, making the lower entrances from the water; but if building by a running stream, a large company of beavers combine to build a dam in order to keep the water at the same level. Going up the stream, they gnaw down trees from one inch to a foot in diameter. This is done with their sharp teeth. These trees they float down to the place of building, and lay them across the stream. They fill the spaces in with mud and stones, which they carry between their fore paws and chin. When the water is deep enough that it will not freeze to the bottom, the beavers separate into small families and build their houses on the bank or against the dam. The entrance is beneath the water, and the vaulted roof is well plastered with a thick coat of earth to protect against the wolves.

**Questions**

1. What kind of disposition does the rabbit possess?
2. To what family does it belong?
3. Name other familiar members of this family.
4. State the differences between the rabbit and the hare.
5. Where is the home of the hare? Of the rabbit?
6. What is their food? When do they secure it?
7. Describe a rabbit's burrow. How does the rabbit guard its young?
8. Where are the rabbit and the hare regarded as pests? Why?
9. Describe the beaver. Where is its home? How does it regard man?
10. In what does the beaver show great skill and intelligence? Give an account of its home building.

**Note Book Requirement**

On page 90 write a story about the beavers as home builders.

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## Lesson XCI

*Flesh-Eating Animals*

The cat has about fifty wild relatives, which have been called its "country cousins." Some of these may be seen in the menageries and zoological gardens. You probably will not be able to see more than ten of these flesh-eaters, but this will well repay you for your time and money.

How do we know that the leopard, tiger, lion, panther, lynx, and jaguar, are near relatives of the cat? —

CHILDREN AND THEIR PETS

In the first place, they look like the cat, except that they are much larger. If we could stand the cat with all her relatives in a row according to size, we would have a cat at one end and a lion at the other. These wild cousins are very restless in their cages; for they are used to a wild, active life.

A WILD RELATIVE OF THE CAT

A lion cub playfully wrestling with its native attendant. "It was gentle with him, and seemed to take great care that it did not scratch him with its claws."

Their legs, ears, tails, teeth, whiskers, and limber bodies, are like those of the cat. Their claws are sharp, and can be drawn in; so that, like puss, these animals move noiselessly about upon their soft, cushioned paws. But the pupils of their eyes are always round, and do not draw into a slit in the daytime as do those of our domestic cat.

Do you know where the cat's cousins live when they are at home? The home of the lion is in Africa and southern Asia. He lives in the forests and on the sandy plains. The tiger hides in the grassy jungles of India. The leopard and the panther abound in tropical Asia and throughout nearly all Africa. The hunting leopard called the *cheetah* lives in Africa. This animal is tamed and used by hunters to chase and catch the antelope.

The *jaguar*, sometimes termed the American tiger, lives in Texas and South America. The *puma*, commonly known as the panther or cougar, is the American mountain lion. It will not attack man unless cornered or very hungry. It has lived in all parts of this country, but it retires before the settler. It still lives in the wilder districts.



The *wild cat* is a native of Europe, and looks like the tame striped cat. A spotted or red *lynx*, with pointed ears and a short tail, is the wild cat of America.

Most of these animals, like the cat, quickly steal up close to their prey, and then spring upon it. Some leap from their hiding places to the backs of their victims. The lion and tiger do not purr, but the others do.

The *cheetah* and *hyena* are doglike cats. They look like a dog, but purr like a cat. They have short bodies, long legs, and carry the tail in the same manner that the dog does.

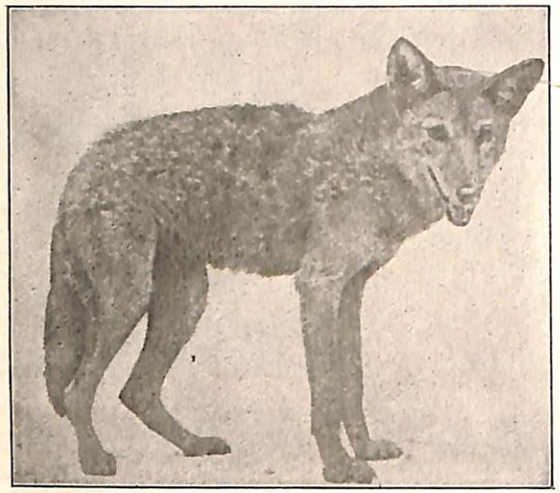
The "wild country cousins" of the dog are not so numerous as those of the cat, neither are they so large. You can easily see the dog's face as you look into the face of the wolf, coyote, or fox, although the nose of some of these animals is longer and sharper than that of the dog.

The *fox* is a very cunning creature, with a long, sharp nose. It lives underground, but does not dig its own den. It drives the rabbit and the badger out of their homes, and takes possession. The red and the gray fox live in America, and another kind of fox lives in Europe. The *red fox* is the largest of its tribe, and is about the size of the common spaniel dog.

The *coyote*, or prairie wolf, of the Rocky Mountain region, is a little larger than the fox. He is very swift footed and a very noisy creature. Two or three can set

up such a howling that one would think a large pack of coyotes were around.

The *gray wolf*, of America, is the largest of the wolves, and the most savage. It is about the size of the Newfoundland dog.



COYOTE

The *dingo*, of Australia, and the *jackal*, of Asia and Africa, are wild cousins of the dog. They are about the size of the shepherd dog. The foxes that Samson used in burning the grain of the Philistines, are supposed to have been jackals.

The wild dogs are all beasts of prey, and they live chiefly on the animals they catch, such as deer, sheep, lambs, rabbits, and wild and domestic fowls. Examine the teeth of the dog and notice how they are adapted to cutting and tearing flesh food.

Foxes usually hunt in pairs, and the wolves and jackals in packs. But all the wild dogs are cowards when alone.

Jackals and dingoes seldom trouble human beings. The jackals prowl around at night, searching for the prey which other beasts have killed. In ancient times they lingered around battle fields, and devoured the bodies of



the slain. So David said of his enemies, "They shall fall by the sword; they shall be a portion for foxes [jackals]."

Spell and define

| | | | |
|---|---|---|---|
| men ag′ er ie | chee′ tah | pu′ ma | din′ go |
| zo ö log′ ic al | wolf | lynx | jack′ al |
| ja guar′ | coy′ o te | hy e′ na | fox |

Note Book Requirement

On page 91 write the names of the wild relatives of the cat and dog, and the home where each lives.

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## Lesson XCII

### *The Hoofed Animals — The Cow*

All these blessings shall come on thee, and overtake thee, if thou shalt hearken unto the voice of the Lord thy God. . . . Blessed shall be . . . the fruit of thy ground, and the fruit of thy cattle, the increase of thy kine, and the flocks of thy sheep. Deut. 28: 2, 4.

The cow is a hoofed animal, covered with hair, and belongs to the family having two toes on each foot. Cows are found almost all over the world; and the herding of cattle has always been a very important industry.

There are different breeds of cows. Among the domestic cows of different countries are some very odd-looking creatures. The *Hungarian cow* has long, straight horns. The *sacred cow (zebu)*, of India, carries a queer hump on its shoulders. The *yak*, of Tibet, has extremely long hair. It runs wild, like the buffalo, but is easily tamed. The *Ayrshires* are from Scotland. They have

long, spreading horns, and are red and white in color. They yield a large quantity of milk. The *Holsteins* are brought from Holland, where the dairymaids milk the cows, and where the cow stable joins the kitchen, and is kept as clean as the kitchen.

CATTLE IN AFRICA

The *Jersey's* native home is on an island bearing the same name, situated in the English Channel. Jersey cows are small creatures, but are great butter makers, their milk being extremely rich. The *Alderney* and *Guernsey* cows came from islands bearing their names, near Jersey Island. The round, dark red *Devons*, with graceful white horns, came from Devonshire, in England. What breeds are represented in the cattle that you often see?

Many of the hoofed animals chew the cud. Instead of having one stomach, they have four. Their food first enters a large stomach called the paunch. The grass passes from the paunch into a second stomach, where it is separated into small parcels; and afterward it is thrown up into the mouth again. Here each mouthful is well chewed and mixed with saliva, then it is sent on to the other two stomachs, where it is thoroughly digested. The animal fills its paunch during the pleasant part of the day; and when night comes, or when the sun is hot,



it lies down and chews the food. The tame cud-chewers are the cow, camel, sheep, and goat. The wild cud-chewers are very many; among them are the buffalo, gnu, wild sheep, goat, giraffe, elk, deer, reindeer, and antelope.

The cow provides mankind with various articles of food. However, on account of the rapid increase of disease among domestic animals, care must be exercised in the use of these foods. Cheese, as usually prepared, is very unwholesome. The use of meat is becoming more and more unsafe; and the time is coming when even butter, cream, and milk will have to be discarded.

DRYING HIDES

The cow's skin is made into leather, from which boots, shoes, and harness are manufactured.

The hair is used by masons in making plaster.

The bones are burned and ground into powder, and used by gardeners in fertilizing the soil.

The horns are made into combs and knife handles.

The hoofs, when boiled, yield glue.

The fat is tried out into tallow, from which are made candles for lighting purposes.

**Questions**

1. Describe the hoofs of a cow. Compare them with the hoofs of a horse.
2. In what ways are cows of value?
3. Which is of the greater value, the horse or the cow?

4. Name some of the different breeds of cows, and their native homes.
5. Mention some of the hoofed animals that chew the cud; some that do not.

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## Lesson XCIII

### *The Hoofed Animals — The Sheep*

My sheep hear My voice, and I know them, and they follow Me. John 10: 27.

The sheep is another common member of the hoofed family, and sheep raising is an extensive industry in Australia and on the plains of North America. The sheep is especially valuable for its wool, which furnishes us with material for clothing.

In some cases the wool of sheep is very coarse; but in others it is very fine. In the spring of the year, as warm weather approaches, the farmer or the shepherd relieves the sheep of their warm, woolly coats, which have been of such service during the cold winter months. This is done by clipping off the wool with shears. Frequently the sheep are washed before being sheared. They are afraid of water, therefore the washing is no delightful occasion to them. However, a sheep is a submissive animal, and is dumb "before her shearers." In many countries the milk of the ewe is used as an article of food.

The domestic sheep has a close relative which roams about in the western part of North America and is called



the *Rocky Mountain sheep*. It is larger than the domestic animal, and has very large horns.

The deer, goat, antelope, and elk are all near relatives of the sheep. These wild creatures seem to be more hardy and more graceful in appearance than are the sheep. The domestic sheep, in fact, would soon die off were it not for the care and protection given it by man. The skin of the wild sheep produces two kinds of hair, one being straight and stiff, and the other wavy and soft.

WASHING SHEEP

The domestic goat is raised in Switzerland for the purpose of furnishing milk to the peasants. Both the goat and the sheep can secure a good living where a cow or a horse would not thrive at all. They can climb the mountain side easily, and feed on the scanty grass and the leaves which grow on different kinds of shrubs; hence the domestic goat has often been called the poor man's cow. For the little food which the goat eats, it gives in exchange an abundant supply of milk, and in addition a valuable growth of hair, which can be shorn once a year.

Sheep are harmless creatures, and the lamb is a fitting example of innocence. This animal was chosen by the Lord, on account of its disposition, to be a type of Christ. John, in calling the attention of his disciples

to Christ, said, "Behold the Lamb of God, which taketh away the sin of the world." The prophet Isaiah, in speaking of the crucifixion scene, says of Christ, "He was oppressed, and He was afflicted, yet He opened not His mouth: He is brought as a lamb to the slaughter, and as a sheep before her shearers is dumb, so He openeth not His mouth."

While the sheep and the lamb are used as symbols of Christ, the enemies of Christ are symbolized by the wolf and the goat.

**Questions**

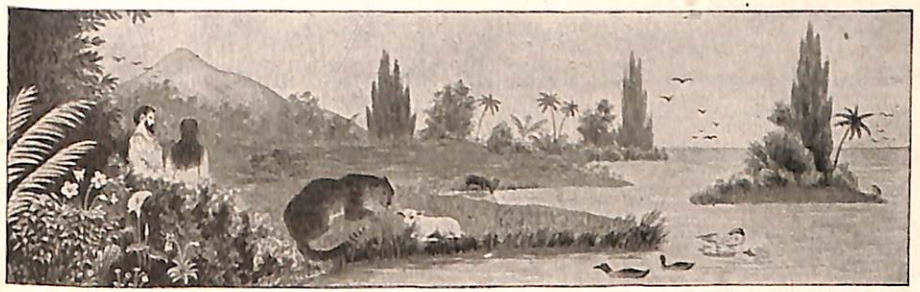
1. In what way is the sheep serviceable to man? Compare its usefulness with that of the horse and the cow.
2. Compare the sheep with its near relatives.
3. Describe a sheep-shearing scene.
4. Where are goats used in place of cows? Why?
5. What is the disposition of the sheep? Of the goat?
6. What are they used to represent in the Scriptures?
7. Of what is wool a symbol in the Scriptures? Isa. 1: 18.
8. Is it in harmony with Scripture to use the skin of animals for clothing? Gen. 3: 21.

½ done

# CHAPTER XI

# MAN

*(Scripture Basis, Gen. 1:26-28)*



*"So God created man . . . male and female created He them."*

## Lesson XCIV

### *The Man Wonderful*

**I will praise Thee; for I am fearfully and wonderfully made. Ps. 139:14.**

The body may be thought of as a wonderful machine whose parts all bear a certain relation to each other and to the things which the Creator prepared for its perfect operation.

Every machine is made up of separate parts, which are fitted together in a special way, each part capable of doing its own work, and the work of all the parts taken together being quite necessary to the perfect work

of the entire machine. Thus it is with the body. The various parts of the body are so nicely built and fitted together that no part is useless, but all the parts must be taken together to make the perfect machinery of the "man wonderful."

If we could look inside of this living machine, examine the shape and size of all the parts of the body, see where they are placed, and how they are joined together, we could well say with David, "I am fearfully and wonderfully made." This would be a study of the *anatomy* of the body.

If upon our examination of these separate parts, we stop to inquire concerning the uses of the various pieces which we find within, we shall be learning the *physiology* of the body. This will help us to understand why David said, "Marvelous are Thy works."

Lastly, when we have learned something of the organs of the body and of the work of each, if we stop long enough to learn how to keep from injuring these parts,— in other words, how we may best care for them, and so preserve our health,— we are studying the *hygiene* of the body.

What study could be more interesting or more fascinating than this study of our own bodies? Then, too, what study is more important? What a wonderful thing it is to live and keep in good health! The different parts of the human machine are all really alive. Every part depends for its well-being upon some other part; and if but one of the parts is out of order, we may soon become ill, and perhaps die.



Our bodies are always busy; and, unlike a machine, the body grows. No man-made machinery can grow; neither can it keep itself in repair, no matter how excellent it may be. But this the body machine will do as long as we are in health.

The Creator gave to man an intellect, which makes him different from and higher than any other animal in the world. He made him in His own image; "in the image of God created He him; male and female created He them." He made him upright, and gave him power to choose the right from the wrong. He gave him "dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth." All this God did because He loved man, and wished him to be happy.

**Questions**

1. Where is found the record of man's creation? Read the texts.
2. How did man become a living soul? Gen. 2:7.
3. To what may the body be compared?
4. By whom is this perfect machinery operated? Acts 17:27, 28.
5. To what do all parts of the body bear a certain relation?
6. What is included in the study of the anatomy of the body?
7. What is the physiology of the body?
8. What is hygiene?
9. How is the body unlike a machine?
10. How does man differ from all other animals?
11. Over what did God give man dominion?
12. What does the wise man say of man at creation? Eccl. 7:29.

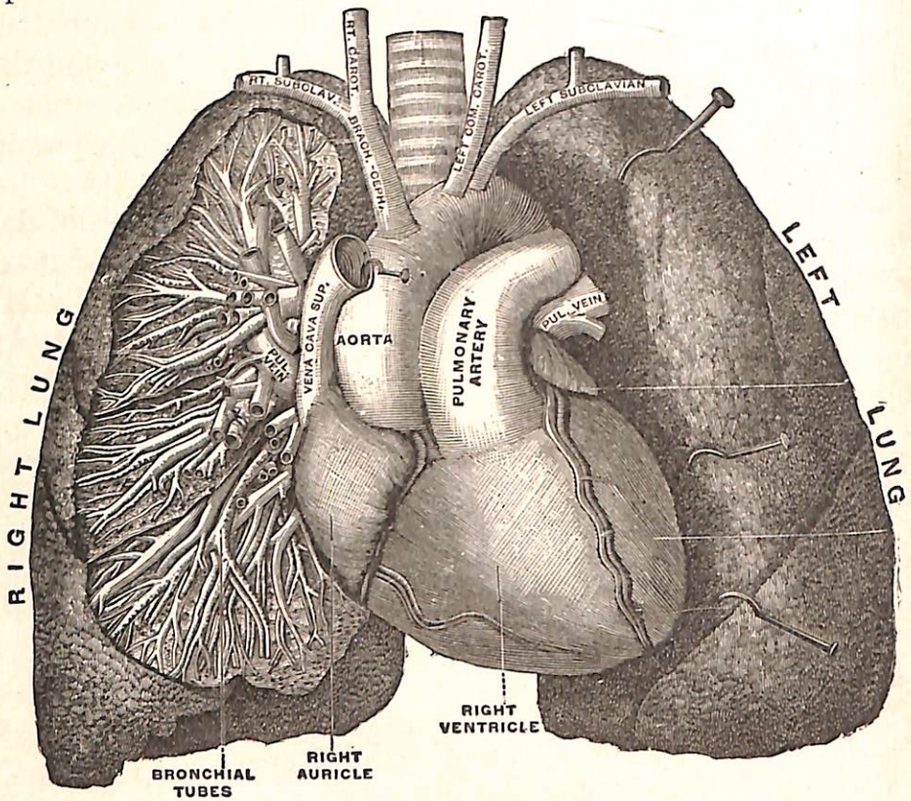
**Note Book Requirement**

Select texts mentioned in this lesson, and copy them upon page 93 of Note Book.

# Lesson XCV

## *The Organs of the Body*

The separate parts of which the body is made up are called *organs*. Each of these organs is adapted to a special use. The eyes are organs of sight, the teeth are




ORGANS OF THE CHEST

organs of chewing, the stomach is an organ of digestion, the skin is an organ of feeling, and the ears are organs of hearing.



These different parts or organs of the body are made up of different materials. On the outside of the body we find *skin*, *nails*, and *hair*. Just below the covering of skin, we find *fat* and the red flesh, called *muscle*. Beneath all these, we find the hard white *bones*. Where these bones come near together, there is a thin covering surrounding their ends, made of a substance called *gristle*, or *cartilage*. And binding all these parts together is a stringy substance which is called *connective material*, because its work is to unite all these other parts.

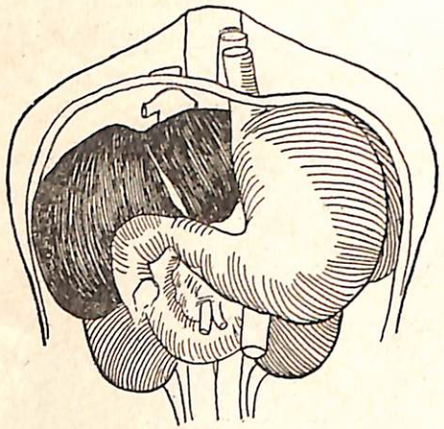
Each kind of material in the body is called a *tissue*. *Connective tissue* is tough, and suited to binding the parts together. *Bony tissue* is stiff, and useful as a support to the other parts. *Cartilage tissue* is elastic, like rubber, and makes springy cushions between the ends of the hard bones. *Muscle tissue* has power to move the parts to which it is joined. Thus we see the wisdom of the Creator in placing a variety of material in the body, and adapting each to its special work.

On examining the body, we find that the head and the trunk contain the most important organs. These are carefully inclosed and well protected by the bones of the skull, of the spine, and of the chest. In the skull we find the *brain;* and in the spine, the *spinal cord*. In the upper part of the trunk are the chief organs of breathing and of the circulation of the blood; and in the lower part are the organs of digestion.

The upper part of the trunk is called the *chest*, or *thorax*, and the lower part is called the *abdomen*. Do you remember where you heard these names before? These

two chambers, the thorax and the abdomen, are separated from each other by the *diaphragm*, a stout muscle that assists in the work of breathing, and forms a floor to the chest and a ceiling to the abdomen.

There are two tubes that run down through the neck and enter the chest. The front one of these tubes is the windpipe, and ends in the lungs. The lungs take up more room in the chest than any other organ. The heart also is in the chest.



ORGANS OF THE ABDOMEN

The second of the tubes mentioned above is the *gullet*. It runs right on through the chest and the diaphragm into the abdomen, and there ends in the stomach. The *stomach*, the *liver*, the *intestines*, and the *kidneys*, all lie in the abdomen. These are very important organs of the body.

The special organs of *seeing*, *hearing*, *smelling*, and *tasting* are all in the head; and the special sense of *touch* is found in all parts of the skin, being present particularly upon the tip of the tongue, the edge of the lips, and the ends of the fingers.

These different organs are all reached by special nerves, and thus are closely connected with the great brain. This organ controls all the body, and collects information from each organ as to its condition and needs.



Spell and define

| | | |
|---|---|---|
| or′ gan | bone | car′ ti lage tis′ sue |
| stom′ ach | skin | con nect′ ive tis′ sue |
| gris′ tle | tho′ rax | spi′ nal cord |
| ab do′ men | chest | mus′ cle tis′ sue |
| in tes′ tines | heart | bon′ y tis′ sue |
| kid′ neys | liv′ er | di′ a phragm |

**Note Book Requirement**

On page 94 of the Note Book tell how the organ of sight is protected, and explain its relation to light.

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## Lesson XCVI

### *Man's Relation to Light*

**The light of the body is the eye. Matt. 6:22.**

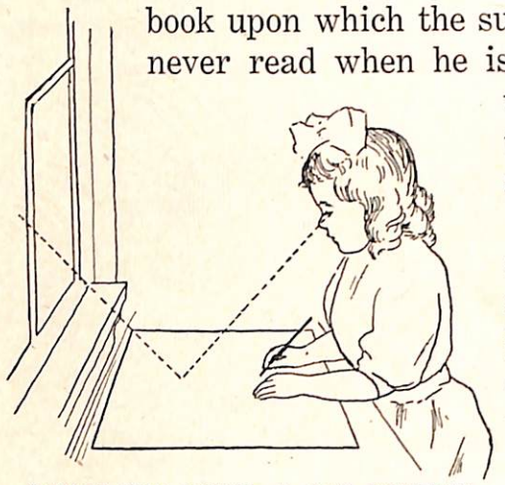
The eye is the organ of sight. It is fitted to receive images brought to it by the reflection of light. The sense of sight is a very precious gift, and is the most wonderful of all our senses.

Sight is necessary not only in the simplest matters of comfort and pleasure, but also to the culture of the mind. For this reason we should use our eyes wisely. They are given to us for use.

The eye has been called one of the gateways to the soul. How many things we learn through the sense of sight! The eye is also an index to one's thoughts. Generally one who does nothing to be ashamed of, will look

at you squarely, with frank, honest eyes; while one who has done wrong, will avoid looking you in the eye.

No strain should be brought upon the eyes. When one is reading, the light should fall upon the book, over the shoulder, and not upon the face. Never read from a book upon which the sun is shining. One should never read when he is not in a position to see well. It is unwise to try to read or do fine work by a dim light.



FACING THE LIGHT—A BAD POSITION

Alcohol and other strong drinks dull the sense of sight. Tobacco is likely to cause a disease of the eyes which dims the sight.

When the eyes have some irritating foreign substance in them, do not rub them, nor pull the eyelids. That is sure to make a bad matter worse. The irritating substance may often be removed by keeping the eye closed for a few minutes, and then pulling the lid away from the eyeball. This will allow the fluid of the eye to wash the particle out.

The eyes are often weak after an attack of scarlet fever, measles, or diphtheria, and should be most carefully used at such times.

Much injury to the eyes is caused by neglecting to wear glasses when they are needed. If your eyes smart when you read, or if you have headache after using your eyes, you ought to see an optician, who will tell you what should be done.



### Questions

1. What has the eye to do with the light?
2. Why should we learn to use our eyes wisely?
3. Mention eight ways in which the sight may be injured.
4. How does intemperance affect the sight?
5. What is meant by the expression "honest eyes"?

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## Lesson XCVII

### *Man's Relation to Heat*

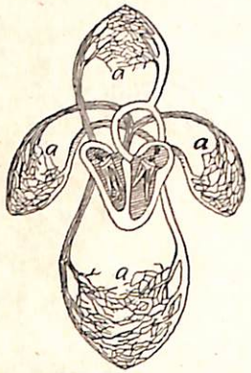
If a brother or sister be naked, and destitute of daily food, and one of you say unto them, Depart in peace, be ye warmed and filled; notwithstanding ye give them not those things which are needful to the body; what doth it profit? James 2:15, 16.

The Creator provides for the body all that is needful for it. He is very appropriately called our "Keeper"; and we are told by the psalmist, "He that keepeth thee will not slumber." Our dearest earthly friends may forget us; but "our help is in the name of the Lord, who made heaven and earth."

We have already learned that the work of producing heat in the body is constant in health, not depending upon whether the weather is warm or cold; and yet this great work is carried forward with very little thought upon our part. It is the work of our Keeper.

We have learned that it is the oxygen in the air

uniting with the wood and coal in the grate that produces heat when the fire is burning. It is the same thing that occurs in our bodies. The food that we eat is like the fuel in the stove; the oxygen of the air enters the body through the lungs, and this oxygen unites with the small food particles which are in the blood, and, as in the case of the fire, the union produces heat.




CIRCULATION THROUGH HEAD AND LIMBS

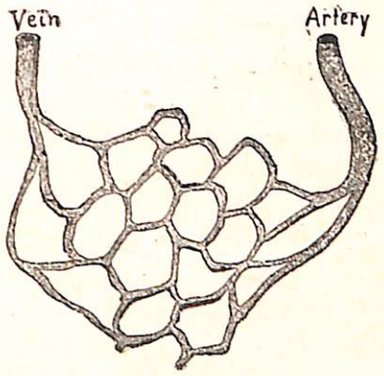
*a*. Capillaries

In order that heat may be evenly carried throughout the body, the Lord has provided a system of circulation, which enables the blood to enter the remotest parts of the body. The heart is the center of this system. It is the great pump which forces the blood through the arteries and into the capillaries; and from these the blood returns through the veins to the heart. Before passing out again, it is carried to the lungs, where it receives a fresh supply of oxygen. Then, passing back to the heart, it is pumped again through the body. This is the wonderful plan that the Creator has provided for heating the body.

I suppose you have often heard persons say, "My hands are cold," or, "My feet are cold; I can not get them warm;" and this, too, on a warm summer day. What is the trouble? — The circulatory system is out of order, and needs to be repaired. One of the best ways to do this is to take exercise. Often a lack of exercise will result in poor circulation.



Are you familiar with the heart, the wonderful machine which forces the blood to every part of your body? It is pear-shaped, and is divided into four chambers, two *auricles* and *two ventricles*. The auricles are situated in the upper part of the heart, while the ventricles occupy the lower portion. Let us follow the blood in its circulation through the body.




BLOOD VESSELS

We will begin with the right auricle. The blood passes from the right auricle into the right ventricle. From there it is forced through two large arteries into the lungs. These are called the pulmonary arteries. It passes through the tiny capillaries of the lungs; and, becoming laden with oxygen, it returns to the heart through the pulmonary veins into the left auricle. From there it passes into the left ventricle. It leaves the left ventricle through the great artery called the *aorta*, which divides into several branches.

Some of these carry the blood into the head and the upper limbs, while others carry it downward, supplying the stomach, liver, and other parts of the body, finally ending in the lower limbs. It is brought back to the heart from these extremities by means of veins. Two large veins enter the right auricle, one coming from the upper portion of the body and one from the lower, and a new circuit is begun.

Spell and define

| | | |
|---|---|---|
| ox′ y gen | fu′ el | cap′ il la ry |
| au′ ri cle | heart | cir cu la′ tion |
| ven′ tri cle | a or′ ta | cir′ cu la to ry |
| ar′ ter y | veins | pul′ mo na ry |

Questions

1. How is heat made in the body?
2. Where does air enter the body?
3. Where does food enter?
4. Where in the body do the oxygen of the air and the food unite?
5. What means has the Lord provided whereby the heat may be evenly distributed throughout the body?
6. What is the center of the circulatory system called?
7. What is the work of the heart?
8. How is the blood carried from the heart throughout the body? How is it conducted from the different parts of the body back to the heart?
9. What system of small vessels connects the arteries with the veins?
10. How is the blood taken from the heart to the lungs and back again to the heart?
11. Where in the body is the heart located? What is its general shape? Into how many chambers is it divided? What are these chambers called? Name and locate each.
12. Trace the flow of blood from the right auricle throughout the body and back again to the starting point.
13. What is the color of the blood in the arteries? In the veins? What makes the difference in color?
14. What is the name of the large artery through which the blood leaves the heart?
15. Why is it that so many people suffer with cold hands and feet, when the Creator has provided them with a perfect means for heating the entire body?



Note Book Requirement

Make drawings representing the heart, with its four chambers, and the complete circulatory system, showing the arteries, capillaries, and veins.

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# Lesson XCVIII

## *Man's Relation to the Air*

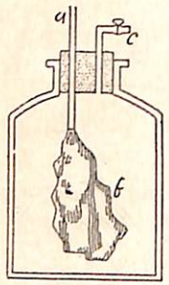
**And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul. Gen. 2:7.**

As soon as God formed man, He breathed into his nostrils the breath of life, and man became a living soul. In common with every other living animal, from ourselves down to the tiniest creature that lives its brief life in a single day, we must constantly depend upon the Creator for this "breath of life." Night and day, from the first to the last instant of our lives, does He give us breath. About eighteen times every minute, without thinking anything about it, we draw the breath in and send it out; and it is impossible to hinder this breathing and live.

The air may enter the body through either the mouth or the nostrils; but the nostrils are the real passageways for the air; and to breathe through the mouth is very harmful. The air passing as it should through the nose, is strained and warmed before it goes on down the windpipe, or *trachea*. If you feel the front of the neck with the fingers and thumb, you will easily discover the trachea.

This tube through which the air passes, is made of a series of hard rings one on top of the other. These are not complete rings; but they are arranged with the opening in each ring toward the back of the neck.

The trachea divides into two main air tubes four or five inches below the back part of the mouth. Each of these main divisions divides again and again many times, until we have the finest possible divisions, like the fine, netted veins of a maple leaf. At the end of each of these tiny tubes, there is a minute air *sac*. There are thousands and thousands of these air sacs; and together they make up two soft, spongy, pink masses, which fill with air each time we inhale, and empty when we exhale.



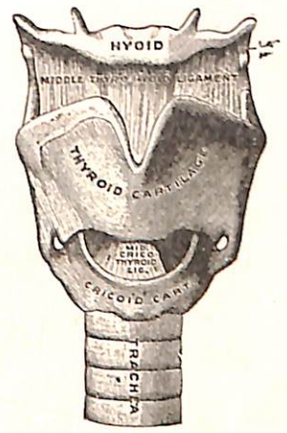

*a*. Air tube to sac
*b*. Rubber air sac
*c*. Tube for drawing out air

The right lung is the larger of the two, having three parts, or *lobes*, while the left lung has but two lobes. Inside these lobes is the finely woven network of arteries, veins, and capillaries. The chest is lined and the lungs are covered with a soft, delicate lining, always kept moist, which prevents all rubbing of the parts one upon another.

We have already noticed that the diaphragm is the floor of the chest. This broad, flat muscle has a great deal to do with the act of breathing. Every time this floor is pressed down, there is a rush of air down the air passages into the lungs. When the floor is raised, the same quantity of air is driven out of the lungs again. The air sac in the bottle acts upon the same principle. The sac expands when the air is drawn out of the bottle at *c*, the air rushing in at *a*.



In addition to the wonderful work that the air does in the lungs, it does another wonderful thing as it escapes through the *larynx*, or boxlike "top of the windpipe." The larynx is composed mainly of cartilage; and upon the sides are strips of firm fibrous material, capable of tightening and vibrating as the air passes over them, and thus producing voice. These membranes in the larynx are called the *vocal cords;* and the longer the cords, and the larger the larynx, the deeper the voice. Voice may exist without speech. The throat, teeth, palate, nose, tongue, and lips must all assist the voice in the utterance of words.



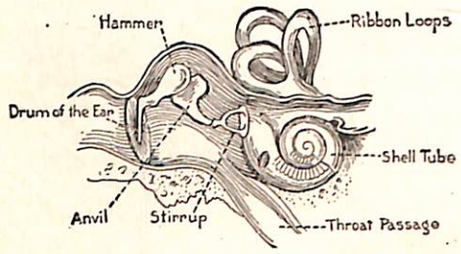

THE VOICE BOX

Resting upon the top of the larynx, and carefully covering it, is a peculiar trapdoor which can open and shut just when it should without our thinking much about it. This little covering is called the *epiglottis*, and is of much use in keeping our food and drink, and everything except air, out of the trachea.

The nerves of smell, which spread out in the upper part of the soft, velvety lining of the nostrils, depend upon the air for the odors with which we come in contact everywhere. The seat of smell being located in connection with the breathing organs, we can know when the air is impure; but if one persists in breathing through the mouth, he can not be thus warned. Then, too, the throat of a mouth-breather becomes dry; and the cold air chills the warm blood in the capillaries of the lungs, and thus

causes trouble. One of the easiest ways to keep from taking cold is to breathe through the nose.

The ear is another organ of the body that must be operated by the air. The waves of sound travel through the surrounding air at the rate of one thousand one hundred ninety feet a second. These are caught by the *external* ear, and passed through a canal about an inch in length, when they reach a thin membrane called the *eardrum*. This is at once set in motion by the waves of sound, and the motion is transferred to the three little bones hung across that part of the ear which is known as the middle ear. From the middle ear the vibration, or wavelike motion, is carried into the canals and loops of the *inner ear*, the fluid of which bathes the nerves of hearing. These nerves carry the sound message to the brain, which is the center of hearing.



THE EAR

What delicate organs are all these which we have thus far studied! How wonderfully they are adapted to do the work for which they were made! "He that planted the ear, shall He not hear? He that formed the eye, shall He not see?" Ps. 94: 9.

**Spell and define**

| | | | |
|---|---|---|---|
| nos′ tril | sac | di′ a phragm | ex ter′ nal ear |
| tra′ che a | lobe | vo′ cal cords | mid′ dle ear |
| lar′ ynx | lung | ep i glot′ tis | in′ ner ear |
| or′ gan | speech | car′ ti lage | ear′ drum |



**Note Book Requirement**

Explain the illustrations found on page 96.

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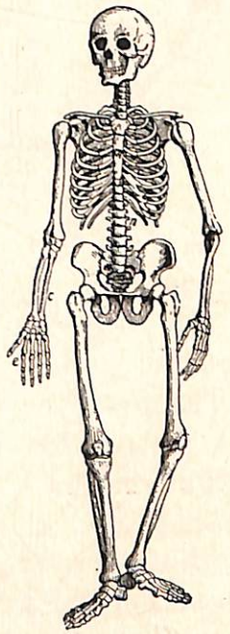
## Lesson XCIX

### *"He Knoweth Our Frame"*

**Thou hast clothed me with skin and flesh, and hast fenced me with bones and sinews. Job 10:11.**

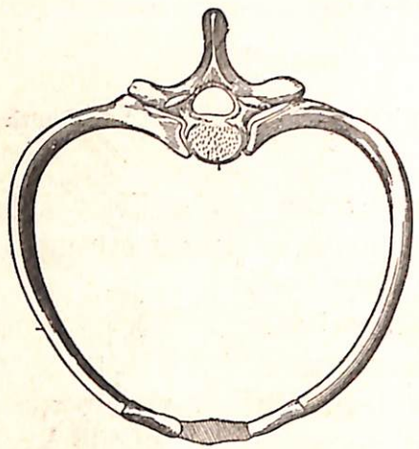
The bones are the framework of the body. They are to the body what timbers are to a house, giving it strength and form. The bones in the living body do not look like the bleached, dry bones which we find after the body of an animal has decayed; but they are of a beautiful pink color, and are pierced by blood vessels, which convey the blood containing the material for the growth of the bones.


THE FRAMEWORK OF THE BODY

The bones are something more than a mere framework; they serve many other useful purposes. For example, they protect the soft and delicate structures which lie beneath them, such as the brain, heart, and lungs. The upper portion of the head — sometimes called the brain case, or skull — is composed of eight bones tightly locked together at the seams in a manner resembling what carpenters call "dovetailing." The bones surrounding the lungs

and the heart form a barrel-shaped cavity, and thus they protect these vital organs.

As we look at the human frame, we see that it is naturally divided into four parts. First, the head, which might be called the cupola of the body, having windows, — the eyes. Besides the eight bones forming the skull, there are fourteen that give shape to the face. Second, the trunk; this is the main portion of the skeleton. The principal bones of the trunk are the spine, the ribs, and the hip bones. Third, the upper limbs, more commonly called arms. Fourth, the lower limbs, which are generally called legs.



RIBS

The spine, or backbone, is the main pillar of the building, and consists of a tapering pile of twenty-six separate bones, one on top of another. The backbone gives a graceful form to the body, unless it has been deformed by improper sitting, or other causes. The seats in many of our schoolhouses are so constructed that they deform the body and ruin the health. Between the bones of the spinal column are placed little cushions of cartilage. These help to break the force of any shock which may come to the body, just as the springs of a carriage lessen its jolting.

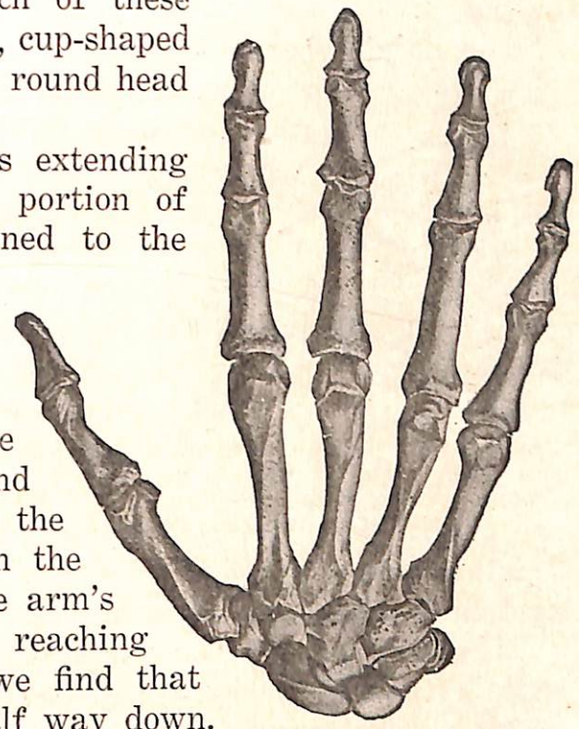
The ribs, twenty-four in number, pass from the backbone around to the front like the hoops of a barrel, and



form the front wall, or chest. The last two ribs on each side are too short to reach the breastbone, and are called floating ribs.

The two hip bones are the largest bones in the trunk. They might properly be called the sills of the house in which we live. Each of these bones contains a deep, cup-shaped cavity into which the round head of the thigh bone fits.

The two branches extending out from the upper portion of the trunk are fastened to the trunk by the shoulder blades. Each arm consists of three large bones and several smaller ones. The small bones are found at the extremity of the arm, and go to form the hand. Instead of the arm's being one long bone reaching down to the hand, we find that it is jointed about half way down. This joint is called the elbow, and enables the hand to be used very freely. The bones of the wrist are crowded closely together like the stones of a pavement. They are held in place by strong, elastic bands, or cords. This allows a free movement of the hand, so that with it we can do many kinds of work,

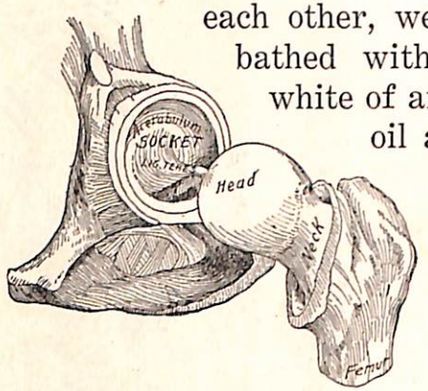


BONES OF THE HAND

from the grasping of a heavy hammer to the threading of a fine needle.

The lower limbs, attached to the lower portion of the trunk, are used in moving the body about from place to place. The feet are constructed much the same as are the hands.

The point where bones come together, and move on each other, we call a joint. The joints are bathed with a fluid something like the white of an egg. As we move about, this oil allows the rubbing surfaces of the bones to move smoothly on one another, thus avoiding friction. When we think of our own bodies, how they are so constructed that they will run themselves and keep the parts well oiled, we certainly must conclude that the Creator made a most wonderful machine. Man has not wisdom enough to produce anything like it.




FEMUR BONE HEAD AND SOCKET, CONSTRUCTED FOR WALKING AND RUNNING

The ends of the bones are different from the main body of the bone; they are covered by a white substance which is called *gristle*. Some of the joints are real hinges. At the elbow we have a *hinge joint*. All our fingers and toes have hinge joints. The most wonderful joints are called the *ball-and-socket joints*. There is one of these joints at the shoulder, where the head of the arm bone fits into a cup in the shoulder blade. This joint is used a great deal in the movements of the arm, as in turning



a grindstone, or swinging a bat when playing ball. Another ball-and-socket joint is found where the leg is joined to the trunk of the body.

But the bones would not remain joined together were it not for the cords which have been provided to keep them in place. Some of these cords — which are called *ligaments* — are very narrow; while others — like those at the sides of the knees, or at the shoulders — are quite wide. Some are very long, like the one in the thigh; while others are very tiny.

INCORRECT SITTING POSITION

If we would have bodies erect and graceful in form, we must look after the health of our bones. The bones of children are very easily bent, because they are soft and gristly. Because of this it is of the utmost importance to keep them from being bent and deformed by bad positions and improper clothing.

CORRECT SITTING POSITION

When one sits on a seat so high that the feet can not rest on the floor, the thigh bones may become crooked, or the backbone may be bent to one side. Sitting at a desk or a table that is too high or too low, makes the spine crooked. Reading with head bent forward causes round shoulders.

All of these habits are more easily avoided than corrected. In order that the framework of the body may be strong and shapely, attention must continually be given to habits of standing as well as of sitting.

Then, too, good material for bone manufacture must be supplied the body. Children living on poor food grow very slowly, and their bones are often deformed for life. Grains, good whole wheat bread, and also potatoes, are rich in food for bone building.

### Questions

1. What is the purpose of the bones?
2. How do the bones differ in shape, size, and structure? Why?
3. Mention some of the bones that are long and slender. Why were they so made?
4. What ones are large and hollow? Why were they so constructed?
5. Mention some bones that are short and thick; some that are short; some that are wide; some that are thin. What kind of work does each perform?
6. What enables the bones to work upon each other without producing friction? Of what are the ends of bones composed?
7. Name different kinds of bone joints. What kind of joints have we in the fingers? Elbow? Shoulder? Thigh? Which joint allows the greatest freedom of movement?
8. What holds the bones of the body together? Describe two different kinds of ligaments.
9. What must we do if we would have erect and graceful forms? What causes people to be bow-legged? Round-shouldered?
10. How may this be prevented?



"How many bones in the human head?
Eight, my child, as I've often said.
How many bones in the human spine?
Twenty-six, like a climbing vine.
How many bones in the human chest?
Twenty-four ribs, and four of the rest.
How many bones in the human arm?
In each, one; two in each forearm.
How many bones in the human wrist?
Eight in each if none are missed.
How many bones in the fingers ten?
Twenty-eight, and by joints they bend.
How many bones in the human hip?
One in each; like a dish they dip.
How many bones in the human knees?
One in each, the kneepan, please.
How many bones in the ankles strong?
Seven in each, but none are long.
How many bones in the toes, half a score?
Twenty-eight, and there are no more.
And now altogether these many bones fix,
And they count in the body two hundred and six.
And now and then a bone I should think
That forms on a joint, or to fill up a chink,
A ses′ a-moid bone, or a wormian, we call.
And now we may rest, for we've told them all."

### Note Book Requirement

On pages 97 and 98 write a list of all the divisions of the body mentioned in the poem, and opposite each division write the number of bones. Add these, and see if your total is correct.

# Lesson C

## *The Muscles*

His flesh shall be fresher than a child's: he shall return to the days of his youth. Job 33: 25.

In the last lesson we learned something about the bones that make up the framework of the body; but the human skeleton is not a beautiful thing to look at, although it is very useful. The Lord has covered the bones with tissue called muscle. The muscles are the fleshy part of the body. They may be distinguished from fatty tissues by their color, being red, because filled with blood. This fleshy muscular tissue causes the arms, face, and shoulders to look full and plump. The whole body contains about five hundred muscles. These vary in size and shape. Some are very large, while others are small; some are shaped like a fan; others are long and round. The Creator manifested the same wisdom in constructing the muscles that He did in constructing the bones. They are so made as to perform their appointed work in the best manner.

SKELETON DRESSED WITH A SUIT OF MUSCLES

The nature of muscles may be illustrated by a piece of India rubber.



Take hold of each end of the piece of rubber, and pull it out long, and you will see that it becomes thinner. When you let go, it springs back to its original shape. Muscles have the ability to expand and contract; but they do not have to be pulled by some one else, as in the case of a piece of rubber. Most of the muscles are attached to bones by cords, called *tendons*. When the muscles work, they pull these tendons, and give motion to the different parts of the body.

It is the brain that tells the muscles what to do. But sometimes these same muscles do things without our knowing that we have told them. We do not have to tell each muscle just what to do when we walk; although there was a time when one step required our whole attention, and even then we often failed, and fell to the floor. But after we learned how to walk, our muscles acted without new commands. Do you not see the beautiful lesson of obedience that we may learn from the muscles?

There are about two hundred fifty muscles used in keeping the body erect, and about two hundred are used in walking. In order to travel a mile, each lower limb must be moved more than a thousand times. The arms at the sides move as often; so the motions of the lower limbs and of the arms amount together to about five thousand. This number, multiplied by the two hundred muscles that are brought into action at every step, gives a product of one million motions performed in walking a distance of one mile.

How marvelous that the human body is so made that

it can perform millions of muscular actions without injury! No iron or steel could endure such a vast amount of work as the muscles of the human body.

It is said that no less than a hundred muscles are used every time we breathe; yet we draw our breath every moment without even thinking of the vast and wonderful machinery that is necessary to do this. But how little do we value this blessing till disease or accident makes us sensible of its worth!

Besides the muscles that move the bones, there are some that give motion to other parts of the body. For example, all the expressions in the human face are produced by the movement of a few muscles. In smiling, the corners of the mouth are slightly drawn up; in laughing, still more so. There are also muscles to pull down the corners of the mouth; and it is by these that the expression of sadness is given to the face.

Pouting is caused by the movement of a muscle that pushes out the under lip; and anger or scowling, by the muscles that knit the brows. In many people these muscles are in frequent use. Any one who desires to have a beautiful face must be careful to have kind thoughts.

The longest muscle in the body is in the thigh. It is about two feet long. The smallest muscle is about one eighth of an inch long. It is in the ear.

The heart is a most wonderful little muscle. The Creator has so made us that the heart acts without our control. Did you ever think what a vast amount of work is done by this useful muscle? At each beat, it lifts about twelve ounces of blood. As the heart beats seventy times



every minute, it lifts in one minute over fifty pounds, and in one hour over three thousand pounds.

In one day — for the heart works steadily on whether we wake or sleep — it lifts more than 72,000 pounds, or thirty-six tons. Nor is this half of all the work it does; because, besides lifting so much blood, it forces the blood all through the body. In one day the blood pumped by the heart amounts to more than three hundred barrels; and a force equal to lifting one hundred tons is used in this work.

It is well that the work of this muscle is not left to our control, for I fear that some children who do not like to work would decide to let their hearts rest. Do you know what would happen then?

Sometimes the muscles contract by sudden fright. Perhaps you have heard it said, "He was so frightened that his hair stood on end." Have you ever noticed the hair on a cat when the cat is frightened? Its hair stands on end because the muscles are holding it in that position.

As we learn more about these wonderful bodies of ours, we shall understand what David meant when he said, "I will praise Thee; for I am fearfully and wonderfully made."

**Questions**

1. With what has the Lord covered the skeleton of the body?
2. What gives the reddish color to the muscles?
3. What purposes do the muscles serve?
4. How many muscles are there in the human body?
5. How do these vary in size and shape?
6. What connects most of the muscles with the bones?

7. How are most of the muscles in the body arranged? Why?
8. How are the muscles controlled?
9. When a person loses control of the muscles, in what condition is his body?
10. Have we any promise in the word of God in reference to our bones?

**Note Book Requirement**

Write about the muscles and their importance upon pages 99 and 100 of Note Book.

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## Lesson CI

### *The Grinding and Tasting Machinery*

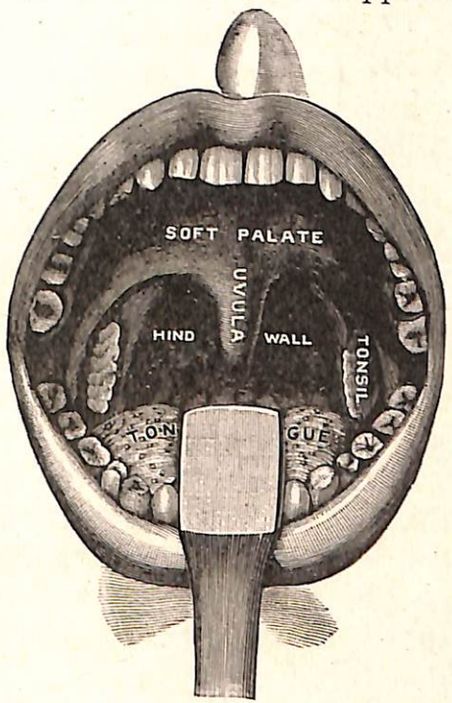
**Whether therefore ye eat or drink, or whatsoever ye do, do all to the glory of God. 1 Cor. 10: 31.**

In this lesson we shall study the mouth, and find out what it does with the food that is taken into it. It is the human mill that receives the food and grinds it so that it is in a condition to be received into the stomach. The teeth are the stones used to grind in this mill. The teeth of man resemble those of the animals which live upon vegetable food, such as the cow, the horse, and the monkey; and their work is very important.

We have two sets of teeth in turn. The first set numbers twenty, and begins to appear when the owner is about six months old. At the age of six years, this set, usually called milk teeth, begins to decay; and a permanent set, thirty-two in number, gradually takes their place. Each tooth is firmly fixed in a socket in the jawbone,



much as a post is set in a hole in the ground. The teeth are covered with a thin layer of a very hard substance called enamel. The inside of each tooth is filled with a delicate substance called *pulp*, which is well supplied with nerves and blood vessels. When the enamel becomes broken or worn from the surface of a tooth, that tooth begins to decay; and the nerves, being exposed to the air, soon begin to ache.

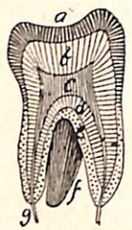


THE RECEIVING ROOM

As the food is ground by the teeth, it is rolled around by the tongue. The tongue is the special organ of *taste;* and its upper surface is covered with rough little bodies in which are located the ends of the nerves of taste. These little bodies, or taste cells, many of which are microscopic, are not distributed evenly over the surface of the tongue, but are more particularly prominent upon the back part.

Taste is the special means by which we discover the flavors of any substance that comes in contact with the tongue. In order for the little taste cells to do their work properly, the tongue must be moist and clean. If coated or parched, "nothing tastes right," we say, and

we do not enjoy our food. Nothing should be done to destroy our taste sentinels. Pepper, spices, and highly seasoned foods dull the sense of taste, and lead to the use of intoxicants.



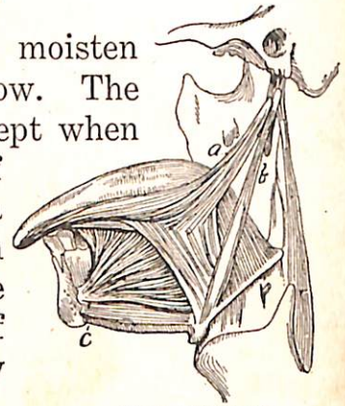
STRUCTURE OF SINGLE MILLSTONE

*a*. Enamel
*b*. Dentine
*c*. Pulp cavity

The soft palate as well as the mouth possesses the sense of taste; therefore an article of food having an agreeable flavor may very properly be spoken of as palatable.

During the time that the food is in the mouth, it is well mixed with a fluid called *saliva*, which flows from little spongy organs called *salivary glands*. There are three pairs of these in the mouth. Sometimes they become inflamed and grow quite large. This condition of the salivary glands is termed "mumps."

It is the work of the saliva to moisten the food and make it easy to swallow. The saliva does not flow very freely except when one is eating. The movements of the jaw seem to produce such a flow, even though nothing be taken into the mouth. Many times the odor, sight, or even the thought of food will stimulate the salivary glands to action.



THE TONGUE

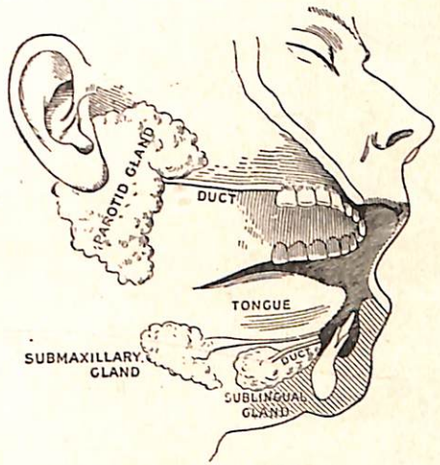
*a, b, c*. Muscles of the tongue

Besides moistening the food, the saliva does another very important work: it acts on the starchy part of the food, changing it into sugar. Were it not for the saliva, the starch could not be dissolved; but when changed into sugar, it is readily dissolved,



and can be easily taken up by the little vessels which carry the food throughout the body.

When we are not eating, the saliva is supplied in small quantities, just enough to keep the mouth comfortably moist. One may excite and injure the salivary glands by chewing gum.




THE SALIVARY GLANDS

When food is well chewed, it is ready to be swallowed. The soft mass is pushed into the back of the mouth, and forced down the food pipe, called the *esophagus*, by a peculiar motion of the muscles. The food, in going from the mouth to the stomach, passes over the little trapdoor about which we have already heard, the *epiglottis*, and thus is kept from falling into the windpipe. In our next lesson we will study the stomach, and learn what we can about how it treats the food.

### Questions

1. What is the purpose of the mouth?
2. Of how many parts does it consist?
3. What part does the grinding?
4. Which of the lower animals have teeth resembling man's?
5. How many sets of teeth have we in our lifetime?
6. How many in the first set? How many in the second set?
7. How are the teeth fastened in the mouth?
8. With what thin substance are they covered?

9. Describe the inner portion of the teeth.
10. What results if the enamel becomes injured?
11. While the teeth are grinding the food, how is it moistened?
12. What will stimulate a free flow of saliva?
13. How does saliva act upon starch?
14. What is the result if we swallow our food without chewing it thoroughly?
15. What is the name of the tube which connects the stomach with the mouth?
16. How does the food pass over the windpipe?
17. How should we care for our teeth? *Ans.*— Cleanse them thoroughly after each meal. Do not use the teeth to crack nuts. Why?

**Note Book Requirement**

Explain the illustrations found on pages 101 and 102 of Note Book.

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## Lesson CII

### *The Churning Machinery*

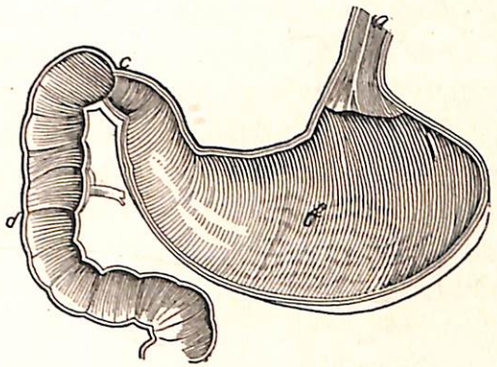
**Neither have I gone back from the commandment of His lips; I have esteemed the words of His mouth more than my necessary food. Job 23:12.**

In the previous lesson we studied the mouth, with its teeth and tongue, and noticed how they act upon the food, and with what results. We also learned how the food passes from the mouth over the windpipe, and down through the esophagus, finally reaching the stomach. The first part of our study was with reference to the grinding of the food, and the second was concerned with the



swallowing of it. The act of swallowing transfers the food from the mouth to the stomach. In this lesson we shall take up the study of the stomach, and notice what further work is done by it on the food.

The stomach is a pear-shaped bag, situated on the left side of the trunk, extending a very little below the lowest pair of ribs. You observe that it is placed where it can be protected by the ribs, the same as are the heart and the lungs.



THE CHURNING MACHINE

*a*. Esophagus
*b*. Stomach
*c*. Pylorus, or gate keeper
*d*. Duodenum

The average stomach will hold about two quarts. The size of the stomach, however, depends upon how much there is in it; for its walls are capable of considerable expansion and contraction.

It has two openings, one where the gullet, or esophagus, connects with the stomach, and the other where the food passes out from the stomach into the small intestine. This latter opening is called the *pylorus*, which means the gate keeper. It will not allow food to pass through it until digested.

When there is no food in the stomach, its walls come together, like a bag which has been emptied. But as soon as we begin to eat, the walls separate, and make room for the food as fast as it enters. It also begins to move with

a gentle, wavy motion, which carries the food around and around as if churning it. This movement is slow at first, but becomes faster and faster as digestion goes on.

In the walls of the stomach there are thousands of little glands, which manufacture a fluid called *gastric juice.* As soon as the food arrives in the stomach, these glands begin to pour gastric juice upon it, thus not only moistening it, but also digesting a certain part of it.

We have already learned that the saliva digests the starch by changing it to sugar. The gastric juice digests another portion of the food,— the *albuminous* portion,— changing it to *peptones.* This substance is so called because it is produced by that part of the gastric juice known as *pepsin.*

The white of an egg, the lean portion of meat, the gluten of flour, are examples of albumen; and upon all such food the gastric juice acts. Some of the food is sufficiently digested in the stomach to pass at once into the blood, and help to build up the body; but most of it passes on through the pylorus into the small intestine, to be acted upon by other juices.

Could we look into the stomach when it is carrying on its work, we would see some wonderful prceedings. The feeling of hunger which we experience is the message which the stomach sends to the brain, calling for food to help build up and sustain the body.

We should be careful that we put into our stomachs only such food as will make good material for building up the body. Alcohol and all other stimulants, among which may be mentioned tea and coffee, paralyze the



organs of digestion. For this reason all stimulants must be avoided.

**Spell and define**

| | | | |
|---|---|---|---|
| stom′ ach | glu′ ten | pep′ tone | in tes′ tine |
| py lo′ rus | glands | pep′ sin | al bu′ mi nous |
| al bu′ men | gas′ tric | e soph′ a gus | di ges′ tion |

**Questions**

1. Where is the stomach located?
2. What is its shape? Size?
3. Describe the walls of the stomach.
4. How many openings has it?
5. Where are they situated? and what are they called?
6. What is the meaning of "pylorus"?
7. What is the condition of the stomach when it contains no food?
8. As soon as the food begins to enter the stomach, what occurs?
9. Explain the motions of the stomach.
10. What fluid does the stomach furnish?
11. What portion of the food does the gastric juice act upon?
12. Name examples of albumen.
13. What happens to some of the digested food while in the stomach?
14. What becomes of the undigested food?
15. How should we treat our stomachs? Why?

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## Lesson CIII

### *The Absorbing Machinery*

**Having food and raiment, let us be therewith content. 1 Tim. 6: 8.**

When the stomach has completed its work on the albuminous food, the gate keeper opens the gate, and

allows the partly digested food to pass out into a long tube, known as the *intestines*, or *bowels*.

The intestines are about thirty feet in length, and so packed away that they do not take up very much room. The first twenty-five feet are called the small intestine, and the remaining five feet the large intestine.

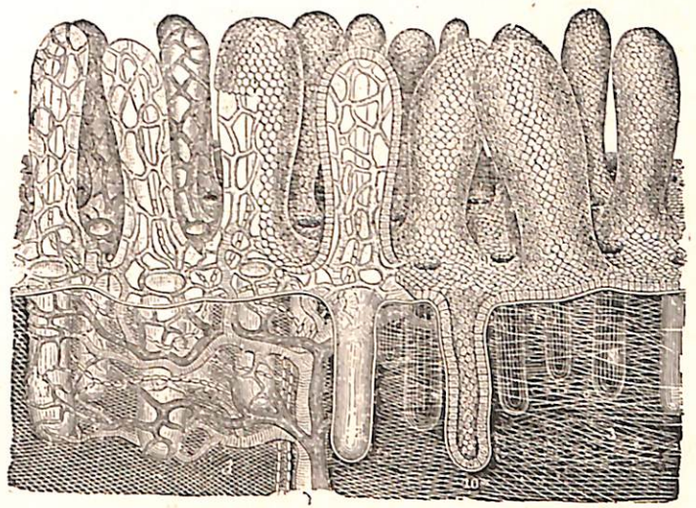
The first foot of the small intestine is called the *duodenum*. When the food enters this, it comes in contact with two fluids which flow into the duodenum through two little pipes. One of these fluids is of a greenish yellow color, and is called *bile*. It is manufactured in the liver, and is sent to the duodenum to do a certain work upon the food. The other fluid, called the *pancreatic juice*, is made by the *pancreas*, another organ of the abdomen. The small intestines manufacture another fluid, called the *intestinal juice*. These three digestive fluids — bile, pancreatic juice, and intestinal juice — do the last work in preparing the food to be taken up by the blood vessels and carried to all portions of the body.

The *liver* is one of the most important organs of the body. It is the largest organ, and weighs from three to four pounds. It is on the opposite side of the body from the stomach, directly beneath the diaphragm. Its lower edge may be felt just below the ribs. The liver is a very busy organ. It does double duty: it inspects the blood's food supply, allowing the material that is suitable for building to pass into the circulation; and it also manufactures the very useful fluid called *bile*. As the liver makes the bile, it stores it up in a little pear-shaped bag called the *gall bladder*.



The fat we eat — such as butter, cream, and nut products — is not digested in the mouth or stomach, but in the duodenum. The bile digests the fat by dividing it into very small pieces, so that it may be taken up by the blood.

The pancreatic juice does a threefold work: it aids in digesting the fats, and finishes digesting starchy foods not already changed into sugar by the saliva, and also the albumen which the stomach has failed to digest.



THE VILLI, OR ABSORBING TUBES OF THE INTESTINES (GREATLY MAGNIFIED)

The intestinal juice changes the cane sugar into grape sugar, and is supposed by some to act upon the salts.

What an interesting work is done by the digestive fluids! The next thing for us to learn is how the food is taken into the system to build it up. The digested food in the small intestine is called *chyle*. This is a thick, creamy mass, and looks very nutritious. The walls of the intestines are richly supplied with blood vessels. Certain parts of the food readily soak through the deli-

cate walls of these vessels, and so are taken directly into the blood. The walls of the intestines also contain millions of short, velvety threads, called *villi*, which means tufts of hair. In each one of these villi is a network of the finest blood vessels, and a tube, called a *lacteal*—meaning milky, because it carries a white, milky fluid. Millions of these lacteals dip down into the intestines like little root fibers, and suck up, like so many mouths, the fatty portions of the food.

**Spell and define**

| | | | |
|---|---|---|---|
| di gest′ | chyme | di gest′ ive | in tes′ ti nal |
| bile | du o de′ num | vil′ li | gall blad′ der |
| chyle | pan′ cre as | pan cre at′ ic | lac′ te al |

**Questions**

1. When the stomach has completed its work, what becomes of the partly digested food, called chyme?
2. How long are the intestines?
3. Into how many sections are they divided?
4. What is the first foot of the small intestine called?
5. When the food enters the duodenum, with what two fluids does it come in contact?
6. From what organs do they come?
7. What is the color of the bile?
8. Describe the liver, and give its location.
9. How does the liver compare with other organs of the body in size and weight?
10. What duties does it perform?
11. Where is the bile stored away?
12. What work does the bile do upon the food?
13. How many kinds of food does the pancreatic juice digest?
14. What is done by the intestinal juice?



15. Describe the small blood vessels, and the villi, with their lacteals.

**Note Book Requirement**

Write a story entitled, "The Journey of a Meal through the Digestive Machinery of the Body." Copy on page 104.

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## Lesson CIV

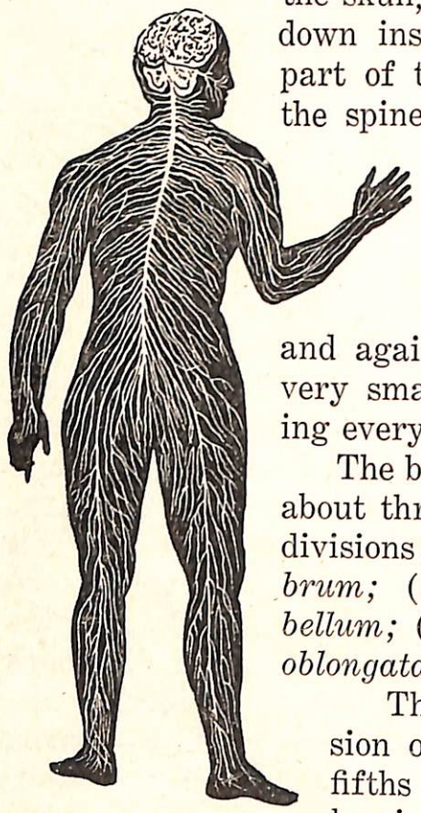
*The Telegraph System of the Body*

Each organ of the body works for the common good of all the other organs. If you strike suddenly at the eye, the lids close to protect it. The muscles of the eye cause the lids to shut. If you tickle the foot, the muscles of the leg will pull it away. And so we might go through the entire structure of the body, and find that there is a general sympathy and a working together of all the parts.

The *nervous system* is that part of the body which has control over all the other parts. It is a complete telegraphic system. The *brain* is the main office, and the thousands of nerve fibers branching off in all directions to all parts of the body, are the telegraph wires. Dispatches are sent constantly to the brain to tell it what is going on in the various parts of the body; and the brain, on receiving the news, sends back its orders as to what must be done. These orders pass through the nerves faster than it is possible for us to think. Should you put your hand accidentally on a hot stove, you would pull it away quickly; for the message is flashed along the nerves

of your hand to the brain, and the brain at once sends a return message to the muscles, saying, "Pull the hand away."

You have already learned that the *brain* lies inside the skull, and that the *spinal cord* runs down inside the spine. At the under part of the skull, where it rests upon the spine, there is a hole in the skull, through which the brain and the spinal cord unite. From these two organs slender threads called *nerve fibers* branch out, dividing again and again, until the last branches are very small and very numerous, reaching every part of the body.



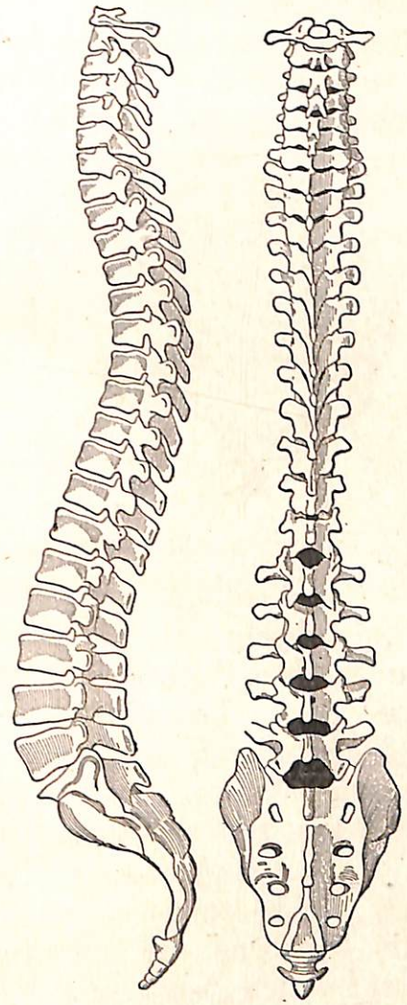
THE TELEGRAPH SYSTEM

The brain of an adult usually weighs about three pounds. It has three main divisions: (1) the large brain, or *cerebrum;* (2) the small brain, or *cerebellum;* (3) the spinal bulb, or *medulla oblongata.*

The *cerebrum* is the largest division of the brain, being about four fifths of the whole. It is divided into hemispheres by a deep groove running from front to back. The right side is called the *right cerebral hemisphere,* and the left side is called the *left cerebral hemisphere.* The surface of the cerebrum is not smooth, but deeply furrowed, and



it is entirely covered with a layer of *gray matter.* The thicker this layer of gray matter, and the more deeply furrowed the cerebrum, the better is the person educated; for it is this large division of the brain that receives knowledge of the great outside world. The nerves of sight send their information to the lower portion of the back part of the brain. Should disease attack this part of the brain, the messages of seeing could not be delivered even though there were nothing the matter with the eyes. Messages of hearing are sent over the nerve fibers to the portion of the brain just above the ears. If this part of the brain is injured, we become deaf, though our ears remain perfect.

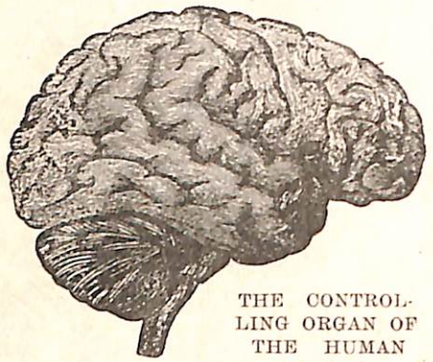


THE CANAL OCCUPIED BY THE SPINAL CORD

Besides receiving messages, the cerebrum, or large brain, directs the motions of our bodies and their parts. The portion of the brain lying just beneath the top of the head sends out all orders for

motion. If this part of the brain were injured, how helpless we would be!

The *cerebellum* lies below the back part of the cerebrum, and is joined to it. It also is covered by gray matter on the outside. When cut through, the cerebellum has the leaflike appearance of the *arbor vitae*. It is the work of this part of the brain to help us in walking or standing. If the cerebellum is injured, we become dizzy and can not walk straight. If the cerebellum of a bird is injured, it can not fly, but will flutter its wings in an aimless way.



THE CONTROLLING ORGAN OF THE HUMAN BODY

The *medulla oblongata* is the smallest division of the brain, being only an inch and a quarter long and about an inch in thickness at its largest part. It connects the rest of the brain with the spinal cord. This small part of the brain is the center of control of some of the self-acting muscles. The center of breathing, that of sneezing, and that of swallowing, are all in the medulla oblongata.

The spinal cord is composed of nervous matter, and extends through the whole length of the spinal canal in the backbone. It is a great route to and from the brain over which messages are received and sent by the central station. It also contains nerve centers enough to control some parts of the body without the help of the brain. These small stations in the spinal cord tell the body when



to eat, and they also inform the arteries how much blood to send to the different parts of the body. We have no control over the action of the spinal cord. It acts when we are asleep as well as when we are awake.

How interesting it is to know even a little of the marvelous machinery of the *nervous system!* How important it is to keep the brain clear to think and calm to direct! Anger poisons the blood and weakens the nerve power. To be well and strong we must be happy and contented.

**Spell and define**

cer′ e brum  cer e bel′ lum  me dul′ la ob lon ga′ ta

**Questions**

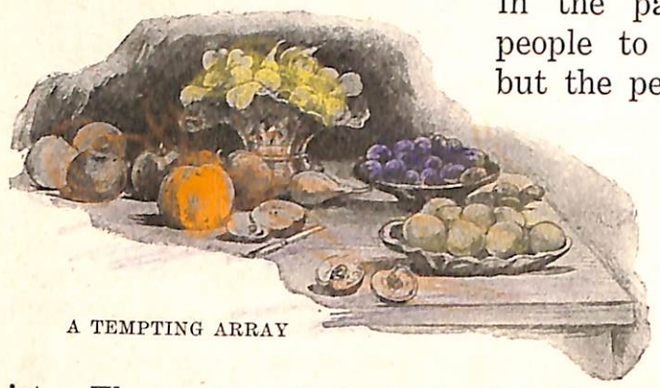
1. What is meant by the *nervous system?*
2. What relation has the brain to the nervous system?
3. What in the nervous system may be compared to telegraph wires?
4. Describe the brain.
5. What is the work of each part?
6. What is the work of the spinal cord?
7. How does the brain of an educated person differ from that of one who is uneducated?
8. What truth does this lesson make plain to you?
9. Why is Jesus called our "head"?

# Lesson CV

## *Proper Diet*

**Feed me with food convenient for me. Prov. 30: 8.**

We have already learned that the vegetable kingdom should furnish man with food. We should endeavor, as far as possible, to conform to God's original plan in this respect. We find, by reading the Bible, that God did, in the past, permit His people to eat flesh food; but the people who live to be translated will be living on a diet in harmony with a condition of things where sin does not exist. The wages of sin is death. Had sin never entered the world, no animal would ever have been killed for food. It seems as if we ought to be glad that we can find food that is wholesome and palatable, without destroying the life of the creatures God has made to contribute to our comfort and happiness.



A TEMPTING ARRAY

We will now consider some of the foods that are nutritious, and that can be easily obtained. Milk is the first food that sustains our bodies, and when pure, is probably one of the best foods. Milk is especially designed to nourish the body during infancy. You will find, by observing the lower animals, that they do not eat the



same food when full-grown as when they are young. This is also true in the case of man.

In our study of the teeth we found that some of them are so constructed that the food may be ground before passing to the stomach. In early childhood the teeth are not adapted to chewing and grinding hard foods, therefore soft or liquid foods are a necessity.

Wheat flour is a very important article of diet. It contains all the food elements necessary to sustain life, except fats. Fruits, grains, and nuts, generally speaking, furnish the best nourishment for man. These can be used together without harm. Vegetables — such as potatoes, beets, and turnips — are inferior to the fruits and grains. While fruits and grains make a good combination, fruits and vegetables make a very poor one. We need not resort to animal food to obtain the necessary fats, for God has provided these in the great variety of nuts, such as the hickory nut, walnut, and peanut.

We should not only be careful in selecting good foods, but should exercise great care in preparing them. Grains should be well cooked, for then they are more easily digested. Frying food is the worst possible method of preparing it, since it can not then be so readily acted upon in the stomach, being surrounded by a coating of fat. Hot bread and hot biscuits are also very indigestible, especially when eaten with butter. Food, in order to be easily and quickly digested, should not be eaten when much warmer than the stomach.

When we are hungry, we find that we are satisfied with very plain food. If we eat when we are not hungry,

we desire rich foods, or those that are highly seasoned, such as pies and cakes, in order to coax our appetite. We should avoid eating anything that we know is unwholesome. The fact that a thing tastes good is not always evidence that it is good. The plainest and simplest foods are the best.

**Questions**

1. What was the original diet provided for man?
2. Why should those who expect to be translated adopt this original bill of fare?
3. What caused man to include flesh foods as a part of his diet?
4. Mention some of the best foods that we find in the vegetable kingdom.
5. What can you say of milk as a food? Of wheat?
6. What is the best combination of vegetable foods?
7. Name a poor combination.
8. What part of the vegetable kingdom furnishes fats?
9. What rule should we observe with reference to eating hot foods?
10. Why should we be careful of our diet?

**Requirement**

Bring to class a properly balanced dinner menu in which is included at least one dish that you yourself know how to prepare.

---

## Lesson CVI

### *How to Eat*

**Bless the Lord, O my soul, and forget not all His benefits: . . . who satisfieth thy mouth with good things. Ps. 103: 2, 5.**

After learning how food is digested in the body, it will be a good plan to learn how to do our part of the



work of digestion. The processes which go on in the stomach are not under the control of the will; but there are certain things which we can control, and they should

GOOD FOOD EATEN WITH THANKSGIVING

be looked after very carefully. To know just how to eat our food is a very important matter.

In the study of the mouth, we have already learned that food should be thoroughly chewed before it is swallowed. If this is done, the other organs of digestion will not need to be overworked. Not less than thirty minutes should be spent at a meal, in order that the food may be properly masticated.

Many children have the habit of "piecing" between meals. This is very harmful, and will soon destroy the

power of a healthy stomach. The stomach needs regular periods of work and rest, just as the muscles do. Three meals a day are sufficient; and those who are not engaged in hard physical labor, are better off with but two meals. It is a bad practice to eat just before going to bed, as this prevents sound sleep. Nor is it well to eat when very tired. At such a time one should rest for half an hour before eating.

One very important thing to remember is that it is possible to overeat. An overloaded stomach makes itself felt by a sense of fullness and drowsiness after the meal. Do not be surprised if you suffer of sick headache after eating too heartily, or if you feel too heavy and stupid to study. If one continues eating too much, especially of too rich or highly spiced food, the complexion becomes muddy, the face marred with pimples, and the breath often has an unpleasant odor.

Much discomfort is occasioned by eating wrong food combinations. Very acid fruits should not be eaten with starchy foods, as the acid of fruits stops the digestion of starch in the stomach. It is better to make a meal almost entirely of fruits than to eat fruits with milk, eggs, or starchy vegetables. When cane sugar is used in large quantities with acid fruits, often the juice sours or ferments in the stomach, thus causing trouble.

Another bad practice which many people have with reference to their eating, is that of drinking freely at mealtime. They wash down their food with cold and hot drinks. This weakens the saliva and the gastric juice, so that they do not do good work upon the foods. Ice water



also lessens the temperature of the stomach, and thus stops the work of digestion for a time.

Ice cream has the same influence upon the stomach as ice water; but it tastes good, and that is the reason why people eat it. Many people live to eat, instead of eating to live.

One very important rule to observe in the matter of eating is this: "Don't worry." Discontent, anger, sorrow, or any other unpleasant feeling, hinders the proper work of the stomach, by calling the blood from the stomach to the brain. "Godliness with contentment is great gain." 1 Tim. 6: 6. A hearty laugh and a merry heart are the best of sauces. Prov. 15:13, 15.

### Questions

1. To what extent can we control the processes of digestion which go on in the body?
2. In what way can we exercise care in the matter of digestion?
3. What kinds of food are usually the most wholesome?
4. What is a good test for hunger?
5. In the matter of discriminating between good and bad foods, what rule should govern?
6. What is the first work that is done upon food when it enters the body?
7. How much time should be taken for a single meal?
8. At what times should we not eat?
9. Is it a good plan to drink freely while eating?
10. Why are ice-water and ice cream injurious?
11. What should be the condition of our minds at mealtime? Why?
12. What important rule should guide us in eating and drinking?

13. On what point did Satan tempt our first parents? *Ans.*— The appetite. Gen. 3:1-7.
14. What will be the condition in the last days? Luke 17:26, 27.

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## Lesson CVII

*Disease and Its Causes*

Disease is a result of the violation of laws that God has given to govern our bodies. Many think that providence is the cause of disease; but this is not true, for God does not delight in seeing His children suffer. Disease comes in consequence of our not sustaining the right relation to the things that surround us. When these violations of God's laws are constantly repeated, disease becomes fastened upon the body, and may result in premature death. Disease is often inherited from one's parents; but if children are properly trained, they can sometimes overcome diseases thus inherited. The laws that govern our being are God's laws as really as are the ten commandments; and if we violate them, we are sinning against God. The Lord is very good to us, not leaving us in ignorance as to how we should care for our bodies.

A TRANSGRESSOR OF NATURAL LAW



We find that the very blessings which are beneficial to us in health, are the agents that we should use to restore the body when diseased. When we learn that we have been exposed to disease, or when we observe its symptoms gaining ground, we should not give up in discouragement; but we should use energetically the means which God has provided for our recovery.

Living in close, poorly ventilated rooms checks the circulation, and causes the blood to move sluggishly through the body. As a result, the mind becomes depressed and gloomy, and diseases of different kinds are easily contracted. Imperfect breathing is another common cause of disease. The internal organs of the body — the stomach, liver, lungs, and brain — suffer if we do not take full, deep inspirations of air. Close confinement indoors causes persons to become pale and feeble. They should be much of the time in the sunshine and pure air.

Eating too frequently and in too large quantities overworks the digestive organs, and is liable to produce a feverish condition of the body. Poorly cooked food is one great cause of indigestion. A free use of sugar tends to clog the system, and frequently causes disease. Milk and sugar combined irritate the digestive organs, and affect the brain. Flesh foods especially increase the liability to disease. Stimulants of any kind lessen the power of the body to resist disease. Tea and coffee, which are so generally used, do a work destructive to health.

Many persons sacrifice their health in following fashions. The body should be evenly covered with clothing suited to the climate. When exposed to cold, there

is danger of contracting disease, especially if the body be weary. It is unsafe to sleep in a room that is not daily exposed to sunlight and fresh air. Drugs enfeeble the system, and make it less able to resist disease.

**Questions**

1. What is disease?
2. Do we sin if we transgress physical laws? Why?
3. Mention some of the common causes of disease.
4. Find scriptures which show that the Lord is willing to heal our diseases.

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## Lesson CVIII

### *How to Restore Health*

**Bless the Lord, O my soul, and all that is within me, bless His holy name: who forgiveth all thine iniquities; who healeth all thy diseases. Ps. 103:1, 3.**

When we repent and are converted, the Lord is merciful, and forgives us our iniquities, or sins. When we are sorry that we have disobeyed the laws of health, and when we stop transgressing God's natural laws, He will restore the body from the injuries that it has received through inattention to these laws. We may become very ill indeed; but throughout the period of suffering, whether long or short, the Lord works with us. He is constantly working to restore the health which man has lost either through ignorance or through a lack of coöperation with his Maker. How encouraging it is that God treats us mercifully in spite of our careless



and heedless ways! How patiently He endeavors to prevent our hurting ourselves!

There are many ways of treating the sick, but there is only one way that God approves. His remedies are the simple agencies that restore the conditions of harmony with divine law. These do not tax or weaken the system. Pure air and water, the fresh sunlight, a proper diet, purity of life, and a firm trust in God, are the remedies that God has given to restore health to diseased bodies. When ill, one should eat less than when well. It is a good plan to fast, and drink only pure water. This will enable the overburdened system to get rid of the poisons that are lodged in it.

A WET-SHEET PACK

The condition of the mind has much to do with the health of the body. Thousands are sick and dying, who might recover if they would control their will and their imagination. They think they are worse than they really are. They should exercise the power of the mind, rise above their bodily pains, and engage in some light but useful employment, which will cause them to forget that they have aching backs, sides, lungs, and heads. A cheerful, thankful spirit is medicine for body and soul.

**Questions**

1. What remedies has God provided for restoring the sick?
2. How should we eat and drink when ill?
3. What influence has cheerfulness upon the body? What does Paul say about contentment? 1 Tim. 6:6.

## CHAPTER XII

# THE SABBATH

*(Scripture Basis, Gen. 2:1-3)*

*"The Son of man is Lord also of the Sabbath."*

## Lesson CIX

### *Creation's Birthday*

**Remember the Sabbath day, to keep it holy. Ex. 20: 8.**

We have followed the master Architect through His plan of forming our world. We have seen each step that was taken after God spoke the world into existence until it was ready for habitation. It has been marvelous to see the world which at first was "without form and void," become, under the hand of its Maker, a world of glory and beauty.

How did the Creator feel when He had completed the work of making a home for man? As He proceeded with





the work step by step, He said, "It is good." But when it was all finished, He said, "It is *very* good." Six days He had labored. During this time He had created the world and made the many beautiful and useful things that it contains.

When all was complete, God spent the seventh day surveying His handiwork. He beheld the sun and the moon giving their light and heat to the earth. He beheld all the beautiful trees and flowers that adorned the earth, and that were to furnish man and the lower animals with food. He saw Adam and Eve, our first parents, in the garden of Eden, their lovely home. He saw the birds flitting about them in joy, and the beasts sporting at their feet. Gladness reigned everywhere upon the earth; and as the Creator of all things beheld what He had made, His great heart of love was filled with happiness. The Scriptures tell us, "In six days the Lord made heaven and earth, and on the seventh day He rested, and was refreshed."

How gratifying it is to us, after we have worked to accomplish something good, to spend a little time beholding our work! We rejoice when success attends our efforts. So it was with God. He took so much pleasure in that day, that He set apart the seventh day of every week as a time for mankind to rest and to study the works of God about them. This day was to bring a refreshing to their souls after the week of labor.

The Sabbath marks the completion of God's work of creating the earth. It is the world's birthday. The Creator set this day apart, making it a memorial of His

creative power. The state and the nation set apart days to bring to the minds of the people important events. Likewise God has given us a memorial day — the Sabbath — that we may keep ever in mind His great work. The Sabbath marks the close of each week. How long will this memorial continue? —"Thy name, O Lord, endureth forever; and Thy memorial, O Lord, throughout all generations."

This memorial day, the world's birthday, will be observed throughout all generations, not only in this world, but also in the world to come. The prophet Isaiah, speaking of the Sabbath in the new earth, says: "And it shall come to pass, that from one new moon to another, and from one Sabbath to another, shall all flesh come to worship before Me, saith the Lord."

**Questions**

1. How many days did the Creator use in building our world?
2. How did He express His satisfaction in His work?
3. How did He spend the seventh day? With what results? Ex. 31:17.
4. What did God do with the seventh day? Why? Gen. 2:1-3.
5. What is the Sabbath to bring to man?
6. What two other names might be given to the Sabbath?
7. Explain the word "memorial."
8. How long will the Sabbath memorial day, or the world's birthday, continue? Ps. 135:13; Isa. 66:23.
9. Can a memorial day, or a birthday, be changed?



# Lesson CX

## *The Sabbath Made for Man*

**The Sabbath was made for man, and not man for the Sabbath. Mark 2:27.**

The Sabbath was not made until after God had created Adam and Eve. So the Sabbath was made for man, and not man for the Sabbath. This holy rest day had its origin at the close of creation. It existed before sin entered this world, and it will exist after sin is taken away.

"Remember the Sabbath day, to keep it holy"

The Sabbath was needed before man sinned; and ever since yielding to sin's cruel power, he has needed it. While in Eden, his time was employed in useful labor. His work was "to dress the garden, and to keep it." He enjoyed his labors, which were carried on without fatigue or tediousness. There was danger that in the delight of his labors, man would become so absorbed in them that he would forget his Maker. Therefore the wise Creator planned that all labor should be put aside on one day of each week, the last day of the week. On this day man was not to be idle. The Sabbath was to be spent in viewing the wonderful works of God in the earth, sea, and sky. As Adam and Eve meditated upon the things about them, the voice of God spoke to their hearts of His love, power, and wisdom.

To our first parents, the Sabbath was a weekly reminder of their Creator, and of the fact that from Him came all the blessings they enjoyed. This thought, brought home to their hearts afresh each Sabbath day, filled them with a spirit of praise and worship to their heavenly Father.

In the days of their innocence and sinlessness, Adam and Eve needed the Sabbath to remind them of their Creator, that they might always be loyal and obedient to Him who had bestowed upon them all the blessings they enjoyed. During the reign of sin, the children of Adam and Eve need the Sabbath to remind them of their Redeemer, who not only had power to create the world, but has power to create within them clean hearts.

If man, even after he had sinned, had always kept the Sabbath, he never would have wandered away from a knowledge of God and into heathen darkness. The Sabbath would have been a continual reminder that the true God is the One who made the heavens and the earth; and man would not have bowed down to images of wood and stone.

So it is plain that the Sabbath has always been needed by man. We should hail its weekly return with delight, and spend its sacred hours meditating upon the love, power, and wisdom of God as made known to us in His word and by His wonderful works all about us.

The Lord says that the Sabbath is a sign between Him and His children that He is sanctifying them. Are we His children? Let us be sure that the sign we hold out before the world in keeping the Sabbath, is not false,



but true. If it is true, then the fact will be seen that the Lord is sanctifying our lives.

### Questions

1. When was the Sabbath made?
2. For whom was it made?
3. How did our first parents spend their time in the garden of Eden?
4. Why did they need the Sabbath?
5. Why have their children needed it?
6. If man had kept the Sabbath even after he had sinned, what would have been prevented?
7. How should we spend the Sabbath now?
8. Of what is the Sabbath a sign?
9. How can we make it a false sign? A true sign?

### Note Book Requirement

On page 107 write what you have learned as to the origin and purpose of the Sabbath.

CHAPTER XIII

# THE FALL OF MAN

*(Scripture Basis, Genesis 2 and 3)*

*"Cursed is the ground for thy sake. . . . In the sweat of thy face shalt thou eat bread, till thou return unto the ground."*

## Lesson CXI

### *The Entrance of Sin*

**For as by one man's disobedience many were made sinners, so by the obedience of One shall many be made righteous. Rom. 5:19.**

Adam and Eve were placed in the lovely garden of Eden, surrounded by everything that could be desired. They were given liberty to eat of all the fruit of the trees of the garden, except the fruit that grew on the tree of knowledge of good and evil.

It was God's purpose that mankind should have a knowledge only of that which is *good;* but Satan led our first parents to become dissatisfied. He led them to be-





lieve that God was trying to keep from them something that would be a great benefit. Hence they wanted to have a knowledge not only of *good*, but also of *evil.*

If an earthly father should give his children a large farm, and a beautiful home in which to live, what would it show on the part of the father? Would not the beautiful garden, with its fragrant flowers and delicious fruits, the flocks and herds grazing in the pastures, the pleasant home planned and built for their comfort, all proclaim the love of the father who had provided these things?

JESUS IN GETHSEMANE

What would we expect would be the feelings of the children, even though the father should ask them to reserve one tree for himself? We would think they were very ungrateful if they did not express their gratitude, not only in words, but in actions. The one request for self-denial on their part, would be regarded not as a hardship, but as a privilege, and as an opportunity for showing their love and thankfulness to their father for what he had done for them.

Our heavenly Father had done all this and much more for Adam and Eve. But they did not appreciate it. They were not willing to be restricted, for fear that they would be deprived of something they would not want to lose. But, O, how much they lost! In the first place,

they lost their Eden home. Not only *they*, but all their children for the past six thousand years, have suffered because of this sin of ingratitude. They have lost the joy, peace, and happiness that would have been theirs if our first parents had been willing to trust and obey their Maker.

Ingratitude, whether cherished toward our heavenly Father or toward our earthly parents, is a terrible sin, which we should earnestly seek to overcome. It spoils our own happiness and the happiness of those about us.

God is particular; and we should be careful to do just what He asks us to do. Cain was not careful to do what the Lord required, but his brother Abel was. How different the history and influence of these two men while they lived, and how different will be their future reward!

**Questions**

1. Describe in your own words Adam and Eve in their Eden home.
2. What restriction did God place upon them as a test of their loyalty?
3. What kind of knowledge did God purpose they should gain?
4. How did they feel about this restriction?
5. How did they show a spirit of ingratitude to their heavenly Father? Illustrate this by the relation of children to an earthly father.
6. What do the first two chapters of Genesis show God's feelings toward Adam and Eve to have been?
7. What does the third chapter indicate as to their appreciation of God's love for them?
8. Is the Lord particular? How did the two elder children of Adam and Eve regard God's requests?



9. What has come to the human family as a result of the sin of ingratitude?
10. Name Bible characters who were careful to follow God's instruction to them. Name some who were not.

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# Lesson CXII

## *The Earth Cursed*

**And unto Adam He said, . . . Cursed is the ground for thy sake; in sorrow shalt thou eat of it all the days of thy life; thorns also and thistles shall it bring forth to thee." Gen. 3:17, 18.**

Because Adam and Eve had failed to stand the test God brought upon them, and were not willing to follow His plan, the Creator had to change His purpose of having them live in the garden of Eden. They were sent forth out of the garden — their beautiful, glorious home.

"By the sweat of thy face shalt thou eat bread"

They were very reluctant to leave it; but God drove them out. And He placed at the east of the garden, cherubim, and a flaming sword, which turned every way, to keep the way of the tree of life.

Mankind were not again permitted to enter the garden of Eden, but they were allowed to approach the entrance.

There they came to receive instruction of God, to confess their sins, and to worship their Maker. God did not allow this wonderful portion of His handiwork to be destroyed. Before the flood, it was transported to heaven.

*For man's sake*, that is, for his good, the ground was cursed. This was because the heart of man had changed, and had become evil. God had to change man's surroundings to correspond with his evil heart. If God had kept everything beautiful and pleasant about mankind, then they would not have realized how dreadful sin is, and how terrible its consequences. Therefore the ground that before brought forth only the good, now brought forth evil also. Among the beautiful, useful plants, sprang up thistles, which are of no value, but which are a constant source of perplexity.

PLOWING IN JAMAICA

As the wickedness of man increased, the curse rested more heavily upon the ground. This caused Adam and his sons more and more toilsome and wearisome labor. Finally another curse was pronounced upon the ground. This came as a punishment to Cain for killing his brother Abel. Cain felt the influence of this second curse, because he was a tiller of the ground and depended upon the soil for his food. The Lord said to Cain, "And now art thou cursed from the earth, which hath opened her



mouth to receive thy brother's blood from thy hand; when thou tillest the ground, it shall not henceforth yield unto thee her strength."

The first curse affected the plants themselves, so that it was very annoying and disagreeable to cultivate the ground and gather the harvest. But the second curse limited the amount of the harvest, thus requiring that more ground be tilled in order to receive the same returns.

A GANG PLOW HAULED BY A GASOLINE TRACTION ENGINE

Consequently the burden of toil has increased as sin has increased. Yet this toil is a great blessing to man. It has kept him from idleness. Some one has said that the idler's head is the devil's workshop. Abundance of idleness was one of the sins that led to the destruction of Sodom.

In the curses that were resting upon the earth, Adam and Eve saw the terrible results of sin. It was with great sadness that they beheld the first fading leaves and drooping flowers. They repented thoroughly of their sin, and earnestly endeavored to teach their children the right way of the Lord. But wickedness increased on every hand, and the Lord visited the earth with a third curse, the flood, which was far more destructive than the two curses which had preceded it.

### Questions

1. Because our first parents failed to stand the test, what did God do with them?
2. Why did He not allow them to remain in the garden of Eden?
3. Did God utterly forsake them? Where did God commune with them, and they worship Him?
4. How long did this continue? Where is the garden of Eden now?
5. What curse was pronounced upon the ground because of Adam's transgression? Why was this done?
6. When did God again curse the ground? Why was it cursed, and with what result?
7. How did these two curses affect man?
8. In what way is labor a blessing? What was one of the sins of Sodom that caused God to destroy it?
9. As Adam and Eve witnessed the results of the curse about them, how did they feel? What did they earnestly endeavor to do?

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## Lesson CXIII

### *The Whole Creation Groaneth*

**The whole creation groaneth and travaileth in pain together until now. Rom. 8: 22.**

We have learned that the three curses pronounced upon the earth because of man's transgression, have brought untold misery and suffering to this world. Not only are the plants, animals, and man affected by it; but as the apostle Paul says, "The *whole* creation groaneth and travaileth in pain." Satan has tampered with all the machinery of creation, so that instead of running smoothly



and noiselessly, without a jar or hitch, it fairly groans under the direction and power of Satan.

The world seems like a machine that has lost bolts, and broken cogs, on account of which the parts slip and jerk, producing a condition that indicates that the whole machine is likely to go to pieces any moment. For the past six thousand years Satan has been tampering with this machinery, which at the close of the creation was running perfectly and smoothly. At that time the Master Mechanic pronounced it "very good." But now how different!

CAPTURE OF A YOUNG TIGER

Satan, called "the prince of the power of the air," has corrupted this life-sustaining agency by filling it with deadly germs of disease, which cause death and destruction everywhere. Again he sets the breath of life in motion, and causes cyclones, tornadoes, and hurricanes, which quickly destroy life and property along their paths.

Heat, one of the most wonderful blessings, is so intensified by Satan's power, that thousands and thousands, especially those living in our large cities, die from heat prostration, called sunstroke.

The very earth itself is convulsed, and trembles from pole to pole, because of violent earthquake disturbances.

Great destruction is also wrought by volcanoes and tidal waves. Whole cities have been buried by streams of

molten lava. Other cities have been engulfed by tidal waves coming in from the ocean. And all this takes place in but a few moments of time.

Wherever we turn, we see that the curse rests upon the earth. Men practice violence against their fellow-beings.

Not only human beings have the spirit of strife and contention, but the lower animals are possessed of the same spirit. They fight and quarrel and devour one another. It seems as if they had caught this spirit from him whom God made ruler over them. Anyway, it is safe to conclude that they would never have had such a spirit if man had not fallen under the power and influence of evil.

All the misery and death in this world are caused by sin; and because Satan introduced sin into the world, he is responsible for all the suffering.

While Satan is doing all he can to tempt and deceive man, and going as far as God will permit in destroying human life, yet God is using all the human agents He can secure to expose Satan's devices, that man may escape his cruel power. Angels are sent to coöperate with man in this great struggle against evil.

Truly "the whole creation groaneth and travaileth in pain" as the mighty struggle goes on between the forces of good and evil; but —

"Right is right, since God is God; and right the day must win.
To doubt would be disloyalty, to falter would be sin."

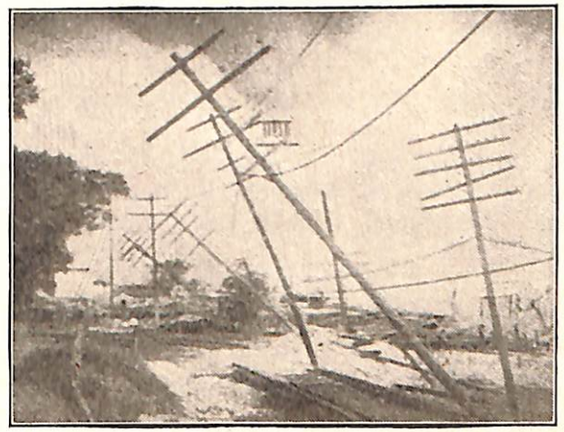


### Questions

1. What three curses did God bring upon the earth? What was the result of each?
2. How much of the creation is suffering because of sin? Rom. 8: 22.
3. How is the air affected by the curse?
4. What other means does Satan use to destroy life and property?
5. Name the most recent earthquakes, and locate on the map the places visited by them.
6. Do the same with reference to volcanoes and tidal waves.
7. Describe the efforts that are put forth to oppose the powers of evil.

### Note Book Requirement

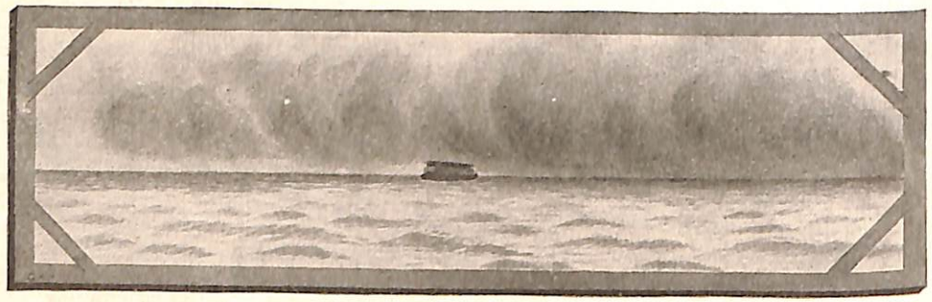
On page 108 give a list of things in the animal, vegetable, and mineral kingdoms, that bear the marks of the curse.



## CHAPTER XIV

# THE FLOOD

*(Scripture Basis, Genesis 6 to 9)*



*"Behold, I, even I, do bring a flood of waters upon the earth."*

## Lesson CXIV

### *The First Earth Perished*

By faith Noah, being warned of God of things not seen as yet, moved with fear, prepared an ark to the saving of his house; by the which he condemned the world, and became heir of the righteousness which is by faith. Heb. 11:7.

The first two curses brought upon the earth did not check man's wickedness. It increased more and more. God determined to destroy man and all his possessions from off the face of the earth. But He did not purpose to do this without giving him an opportunity to be saved. Through Noah the warning message was preached for





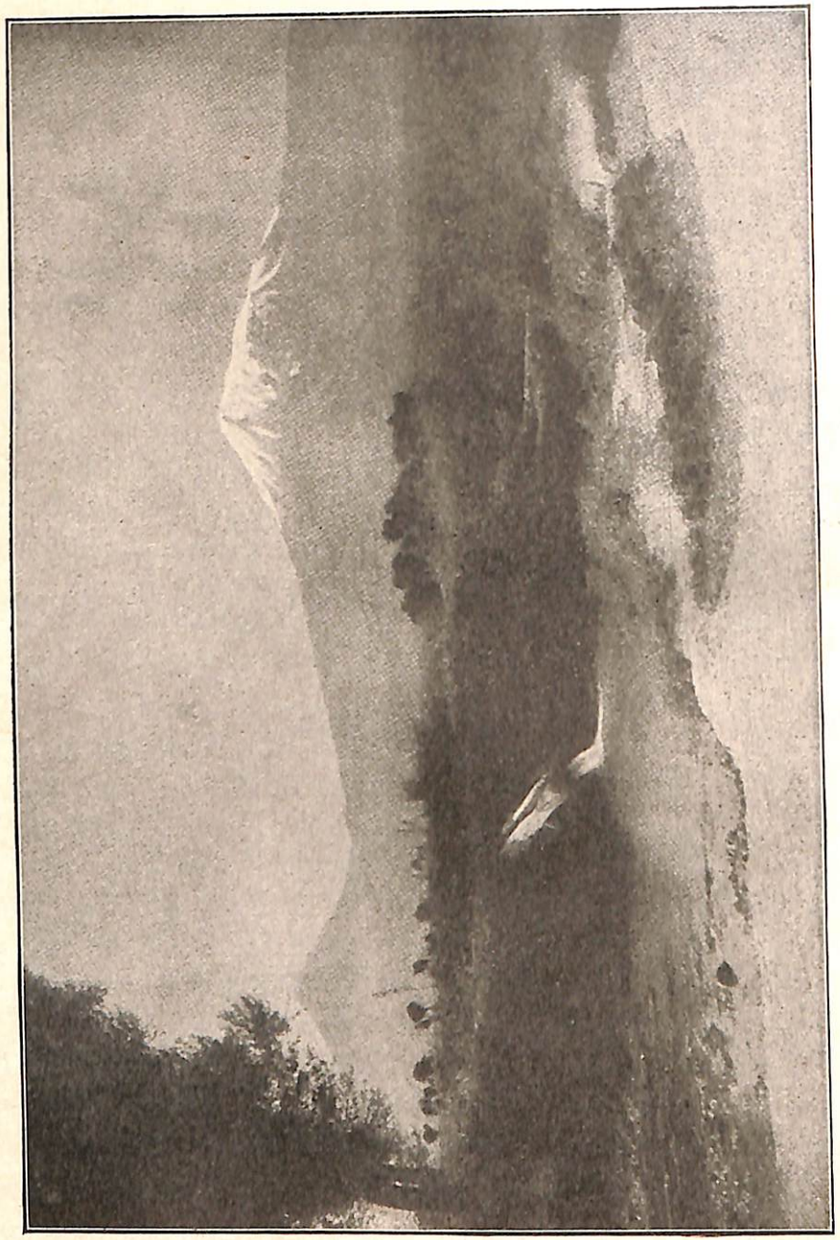
one hundred twenty years. All were given a chance to flee into the ark that Noah was commanded to build for the salvation of those who would heed his message of warning.

Noah manifested great faith in God. He had never seen a flood of any kind; still he went forward with the building of the ark. He believed a thing was coming that he had never seen, when as yet he did not understand how it could possibly come. Up to that time rain had never fallen upon the earth, but the earth had been watered by a mist, or dew, which fell upon the ground at night, and which soon disappeared before the morning sun.

Noah believed God; and for one hundred and twenty years, with the sound of the saw and the hammer, he emphasized the message that he preached. He was ridiculed for doing such a foolish thing as building an ark — a boat — on dry land. But true to God's word, and to his faith in that never-failing word, the flood came; and only Noah and his family were saved in the ark which he had built. Of all the inhabitants of earth, but eight souls escaped destruction by the flood.

It was a dark outlook. It seemed as though God's plan to populate this earth with a race of righteous beings, was a failure, and that Satan was having his way in the beautiful world that God had built.

But the Scripture declares, "He created it not in vain, He formed it to be inhabited." Satan had only *retarded* the working out of God's plan. In the beginning there were two souls, Adam and Eve; but they were



THE FAMOUS ARARAT MOUNTAINS



overcome by the tempter. Their descendants also had not appreciated the opportunity that was offered to them in the plan of salvation, hence they were destroyed. By the flood the earth was again brought to chaos; and God now started over again, not with two but with eight souls. Thus while the enemy caused delay, God never abandoned the plan which He had laid in the beginning.

While the flood was a great curse, and affected the whole earth and everything upon it, yet God turned this curse into a blessing.

**Questions**

1. Mention the three curses that God brought upon the earth because of man's wickedness.
2. Describe the third curse.
3. What did God do that the inhabitants might be saved from destruction?
4. Why did Noah believe the earth would be destroyed by a flood? Heb. 11:7. Why did the people disbelieve it?
5. How many were saved from destruction?
6. How long did it rain? How long did the waters prevail on the earth? How long before the earth was dry enough that Noah and his family could come forth out of the ark? Genesis 7, 8.
7. What became of all living things on the dry land?
8. What was the outlook for God to carry out His original plan of populating the earth?
9. To what was the earth again brought? How many souls did God place upon the earth in the beginning? Gen. 1:27, 28.
10. How many remained after the flood? How did God encourage Noah and his sons? Gen. 9:1-7.

# Lesson CXV

## *Vegetation after the Flood*

At the time of the flood, the Bible tells us, "every living substance was destroyed which was upon the face of the ground." By this we learn that all vegetation was affected by the great deluge. There were forests of giant trees, and these must have been thrown down by the great water currents that swept over the earth. The same currents must have carried sand, mud, and gravel, and buried the forests beneath the surface of the earth.

WHERE WATER HAS WASHED AWAY THE SOIL

As men dig into the earth, they find not only trees, but also animals, buried together beneath its surface. The forests have since been changed into coal, forming large coal beds. In some cases these coal beds have decomposed, forming gas or oil, such as are used for lighting purposes. The coal beds furnish a large amount of the world's fuel. Sometimes a portion of the trunk of a tree and its branches are discovered, all turned into coal. The imprint of leaves and fronds of ferns have been found on fragments of coal.

There are two kinds of coal: (1) Hard coal or *anthracite*, which is hard like a rock. It is usually more expensive, as it is harder to mine, being taken out of the ledge with difficulty. It is usually in small pieces about the size of a hickory nut, and for that reason is sometimes called nut coal. (2) Soft, or *bituminous* coal, which is much softer than hard coal, and many times reveals on its surface the grain of the wood. It breaks up quite easily into large chunks.



Graphite is akin to coal. The substance in our pencils that is commonly called lead, is really graphite. Peat is a coal-like material. It consists of an accumulation of mosses, leaves, and sticks, which have undergone decomposition in low, boggy places. It is found chiefly in the northern countries of the world, and is used for fuel, especially in Europe.

SUBTROPICAL GARDEN

Surely the vegetable world that thrived before the flood is not all lost. God has made a blessing out of the curse in giving us the gas and oil for illumination, the coal for heating, and the graphite for writing and for sketching the beautiful scenes of nature about us.

Of course, hard work is required in digging the coal out of the earth; but labor is good for us, and blessings are the more appreciated because of the efforts put forth to secure them. In some cases we find that forests, instead of turning into coal, have turned into stone. These are called petrified forests. This is the

source of some very beautiful opals and other precious stones.

Coal beds are found all over the world; and thousands of men are employed in bringing this necessary product to the surface. If we had to depend upon our present forests for fuel, we would have had a fuel famine long before now. It is wonderful how God has made it possible for us to go to the forests of four or five thousand years ago to supply our present needs.

The oil fields also are very widely distributed over the world. The oil is drawn up out of the earth by means of large pumps, and then piped for miles into the cities. If you have opportunity, you should visit a coal mine and an oil pumping plant.

Coal, oil, and gas, which are such a blessing to us now, will yet be used as very destructive agencies. Even now these blessings are to some degree turned into a curse, for they aid in causing earthquakes and volcanic eruptions. The following description indicates how the disturbance is created:—

"The coal and oil frequently ignite and burn beneath the surface of the earth. Thus rocks are heated, limestone is burned, and iron ore melted. The action of the water upon the lime adds fury to the intense heat. As the fire and water come in contact with ledges of rock and ore, there are loud explosions, and volcanic eruptions follow. These often fail of giving sufficient vent to the heated elements, and the earth itself is convulsed, the ground opens, and villages, cities, and burning mountains are swallowed up."



**Questions**

1. What was destroyed by the flood?
2. What became of the forests?
3. Into what have these forests been changed?
4. Name the two main kinds of coal, and describe each. What is peat? Graphite?
5. Where are coal, oil, and gas found? Name two states where they abound.
6. How are these products taken out of the earth?
7. How do these blessings become agencies of destruction?
8. How are earthquakes and volcanoes produced?

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## Lesson CXVI

### *Animals after the Flood*

**All in whose nostrils was the breath of life, of all that was in the dry land, died. Gen. 7: 22.**

Noah did not go out into the woods and fields to get animals and take them into the ark; but they, showing more intelligence than man, allowed their Creator to lead them to the ark. The example of the animals as they made their way to the ark, should have been proof that Noah's message was true.

All the animals that lived on the land died, except those that Noah placed in the ark. After the flood dried up, the ground was strewed with the bodies of dead animals. God caused a strong wind to blow, which overturned hills and mountains, and covered the dead carcasses. The whole earth became a vast burial ground.

As men dig down into the earth, they find bones of animals that perished at the time of the flood. From the size of these bones, it is seen that the animals that lived before the flood were much larger than any that live at the present time.

THE GIANT ARSINOITHERIUM

This is a newly discovered horned monster of prehistoric Egypt. The first skull of this wonderful extinct beast has been placed in the New York Museum of Natural History.

The elephant is the largest land animal now existing; but the remains of an animal which very closely resembles the elephant, have been found buried in peat bogs, and in the ice-bound regions of Siberia, in Asia. This creature is larger than our elephant, and is called the *mastodon*. One of these creatures was found buried in a large block of ice; and when the body was taken out, it was well preserved, and the dogs ate the flesh. The skin of this



mastodon was of a dark color, and was covered with reddish wool, one inch in length. The two ivory tusks weighed three hundred pounds, and the animal was twelve or thirteen feet in height.

One mastodon's skeleton has been found, which showed the creature to have been twenty-six feet long from the tips of its tusks to its tail, and the distance between the tips of its tusks was fourteen feet. Each tusk was fourteen feet long, and one foot through at the base. The distance around the animal's body was thirty feet; and across the sole of its foot, three feet. Its height was sixteen feet; and a man could stand upright between its fore legs and not touch its body.

This is only one of the large animals whose remains have been found buried in the ice or earth. The giant sloth of South America, called the *megatherium*, had a body eighteen feet long and eight feet high. The sloth of the present time is a mere dwarf compared with the giant sloth.

The *zeuglodon* was a large whalelike creature that lived in the region of the Mississippi Valley, and its body was sixty to eighty feet in length.

In the book of Job we have an inspired description of three very large animals. This description was written after the flood, about the time of Moses; and the animals described are supposed to have been the whale, the elephant, and the rhinoceros. As you read these descriptions, you will see that great strength is attributed to each one of these creatures.

The elephants live in tropical climes, so it would seem

that the regions near the North Pole, where several mastodons have been found buried in the ice, had a mild climate before the flood.

Warm water corals and immense coal deposits near the pole are strong evidence that the climate of the earth was once very unlike what we now find it to be.

Why are the animals so much smaller and weaker now than before or shortly after the flood? — Because of the weakening and destroying power of sin. All the fossils that we find buried in the earth, prove that the Bible story is true, and that the history it gives of the fall of man and the curses that visited the earth on account of sin, is the only reliable history.

### Questions

1. What became of all the animals that were not sheltered in the ark?
2. How many kinds of animals entered the ark, and how many of each kind? Gen. 7:1-9.
3. How did these lower animals show more wisdom than the antediluvians?
4. What proof have we that many animals were buried beneath the surface of the earth at that time?
5. How did the animals living before the flood, compare with those now on the earth?
6. Describe the mastodon. Where has it been found? What does this prove as to change of climate after the flood?
7. Describe the megatherium and the zeuglodon.
8. What very large animals does Job describe, and what does he attribute to each? Job 39:9, 10; 40:15-24; 41:1-34.
9. What lesson may we learn from the study of the fossils of plants and animals?



# Lesson CXVII

## *Man after the Flood*

**And the Lord said, My spirit shall not always strive with man, for that he also is flesh: yet his days shall be an hundred and twenty years. Gen. 6:3.**

Before the flood, men lived nearly a thousand years. Adam lived nine hundred and thirty years. The patriarch that lived longest was Methuselah. He lived nine hundred and sixty-nine years. Noah, who lived both before and after the flood, lived nine hundred and fifty years.

But after the flood the time allotted for man to live was only one hundred and twenty years; but some were permitted to live a little longer. Abraham lived one hundred and seventy-five years; Jacob, one hundred and twenty years; and Moses, one hundred and twenty years. Thus man's life was so shortened that he lived only about one eighth as long as before the flood. The period of life was still shorter in David's time; for he writes in the Psalms, "The days of our years are threescore years and ten; and if by reason of strength they be fourscore years, yet is their strength labor and sorrow; for it is soon cut off, and we fly away."

At the present time very few persons live to be threescore and ten or fourscore years of age. The average length of life now is only a little over thirty years. A very, very few live to see a hundred years.

Why this great decrease in the length of man's life? — It is all on account of sin.

When God forbade Adam and Eve to eat of the tree of knowledge of good and evil, He said, "In the day that thou eatest thereof, dying thou shalt die." That very day our first parents began to die. They gradually lost their strength and energy until they died at a very old age. God had intended them to live forever; but the longer man has lived, the more wicked has he become, so each new generation has had less power and endurance than the one before. A thousand ailments and diseases have fastened upon the human body; and the thousands of doctors, and tens of thousands of nurses, with all their medicines, are not able to stay the messenger of death, who claims all as his victims. The shortening of man's life just after the flood was an act of mercy; for not being allowed to live a long life of sin, he was thus saved centuries of misery and suffering.

After the flood, God, by confounding their language, scattered abroad the people. It was love that prompted God to disperse them. He could do more for them when they were by themselves in the woods and fields and mountains, than He could when they were huddled together in the cities. He placed them in such portions of the earth as would be for their best good, and where they would most readily be inclined to seek God and listen to the gospel of salvation sent to them. The apostle Paul refers to this in the following words: "God that made the world and all things therein, . . . hath made of one blood all nations of men for to dwell on all the face of the earth, and hath determined the times before appointed, and the bounds of their habitation; that they



should seek the Lord, if haply they might feel after Him, and find Him."

As we consider the inhabitants of the world living in different climates and under different conditions, we find that they differ greatly in color, appearance, and habits of life. Man has been divided into five different classes, or races, as follows: —

THE RACES

1. The white or Caucasian race. This race occupies the New World and most of the Old World — western Asia, India, Europe, Africa along the Mediterranean Sea, and Australia.

2. The black or Negro race. Africa is the home of the black race. Many of this race now live in other countries, especially in the southern part of the United States.

3. The brown or Malay race. Its peoples live in the islands of the Pacific Ocean, the Malay Peninsula, the East Indies, and the island of Madagascar.

4. The yellow or Mongolian race. The Chinese and Japanese belong to the yellow race, also the Eskimos, Lapps, Finns, Hungarians, and Turks.

5. The red race. The American Indians constitute the red race, and were found here when Christopher Columbus discovered America in 1492.

A large portion of the world's inhabitants are still in

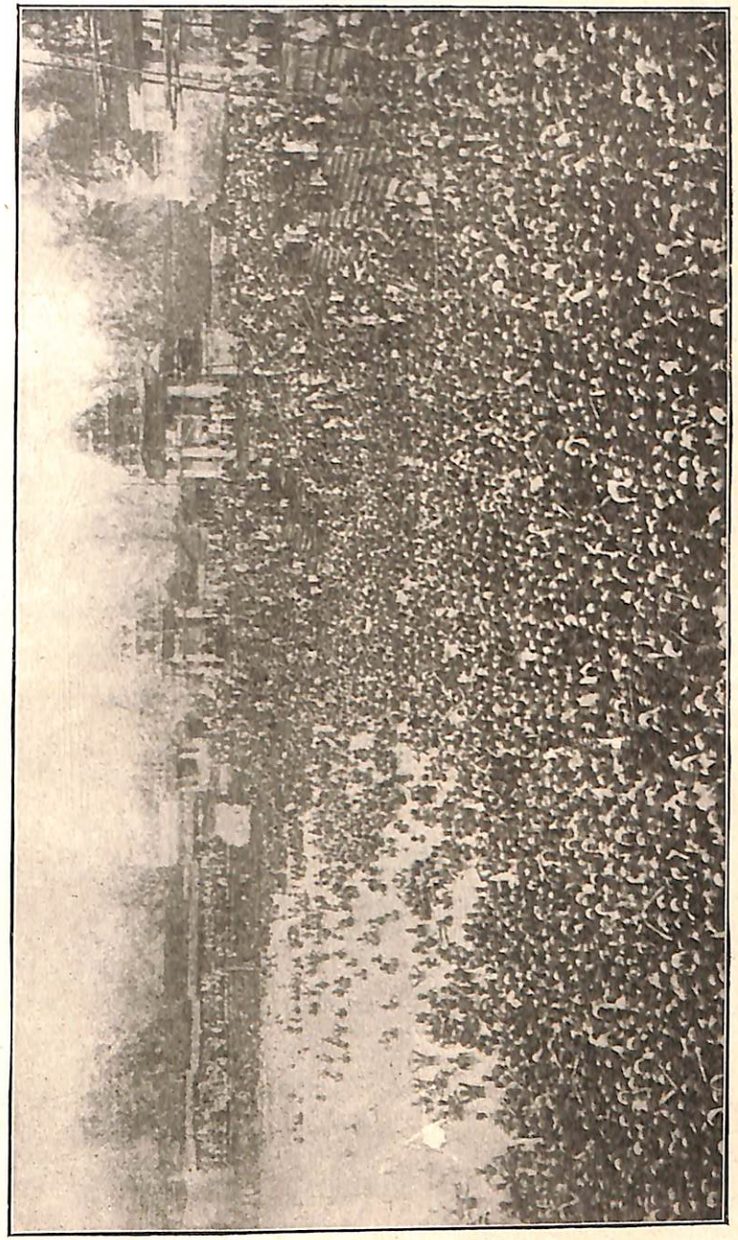
heathen darkness. The largest number of believers in the Christian religion is found in the white race; also the highest state of civilization. The religion of the yellow race is of three different kinds,—Confucianism, Buddhism, and Taoism. The first two get their names from Confucius and Buddha, who were their religious teachers. The third religion gets its name from Tao, who is called the beginning of all things. The religion of the brown race is Mohammedanism, so called from Mohammed, their prophet and teacher. The Koran is their Bible. The red race believe in the "Great Spirit" and the "happy hunting grounds."

The black race are in blackest heathenism, except where they have received the gospel. But all the heathen nations, of whatever race, are sadly in need of the saving gospel of Christ; and in the so-called Christian nations there are many that are heathen at heart. But God has so placed all the races and nations that they can find Him if they will. Christ, when on earth, declared, "This gospel of the kingdom shall be preached in all the world for a witness unto all nations; and then shall the end come." We must do our part in carrying this message.

### Questions

1. To what age did men live before the flood?
2. What was the average length of life of the patriarchs mentioned in Gen. 5:1-31?
3. What age limit did God set for those living after the flood? Gen. 6:3.
4. How long did Noah, Abraham, Jacob, and Moses live?
5. What was the length of life in David's time? Ps. 90:10.





A HEATHEN FESTIVAL

6. What is the average length of life at the present time? Why this great decrease?
7. After the flood, what care did God exercise that man might gain eternal life? Acts 17: 24-27.
8. What has caused the differences in color, habits, and customs of the people scattered all over the earth?
9. Because of this, how have they been classified? Name the five races, and tell where each lives.
10. Describe the religion of each race.

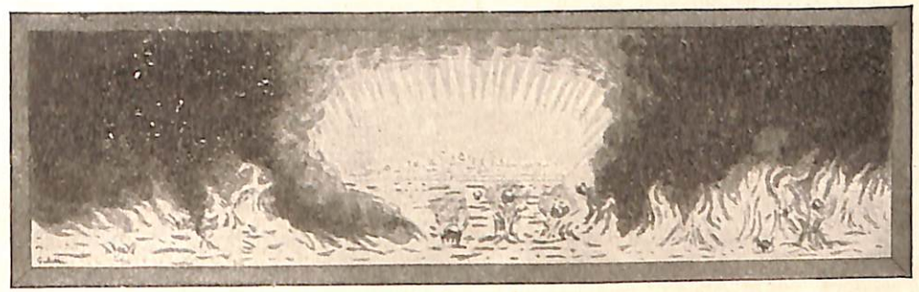
**Note Book Requirement**

On page 109 draw a map of the world, and indicate on it where the different races live at the present time.

CHAPTER XV

# THE FINAL DESTRUCTION

*(Scripture Basis, 2 Peter 3:3-14)*



*"The heavens and the earth, which are now, . . . are kept in store, reserved unto fire."*

## Lesson CXVIII

### *God's Messages since the Flood*

And the Lord God of their fathers sent to them by messengers, rising up betimes, and sending; because He had compassion on His people, and on His dwelling place: but they mocked the messengers of God, and despised His words, and misused His prophets, until the wrath of the Lord arose against His people, till there was no remedy. 2 Chron. 36:15, 16.

God gave to Noah and to his sons a promise that He would never again destroy the earth by a flood of water. What did He give as a pledge and continual reminder of His promise? God did not lose His love for man, nor

cease to instruct and warn him. All through the ages, God has sent messages of warning, instruction, and reproof. Some of these messages have been heeded and some have not.

From time to time God has raised up men to teach the people the way of the Lord. After Noah, God made Abraham a light to the world. Through him and his seed the gospel of salvation was to be made known to the whole world. Beginning with his son Isaac, we have Jacob, Joseph, Moses, Joshua, Samuel, Daniel, Nehemiah, Esther, Jonah, Haggai, Malachi, and many others mentioned in the Old Testament, who were God's devoted messengers of truth.

Coming on down to the New Testament, we read of John the Baptist, who was God's messenger to herald the coming of the Saviour, the Author of the plan of salvation. Christ lived about thirty-three years in the world, showing man how to live, and labor for his fellow-men. Before He returned to heaven, He educated and trained twelve men whom He set apart to carry forward the work He had started. Through their labor the gospel was carried to the world.

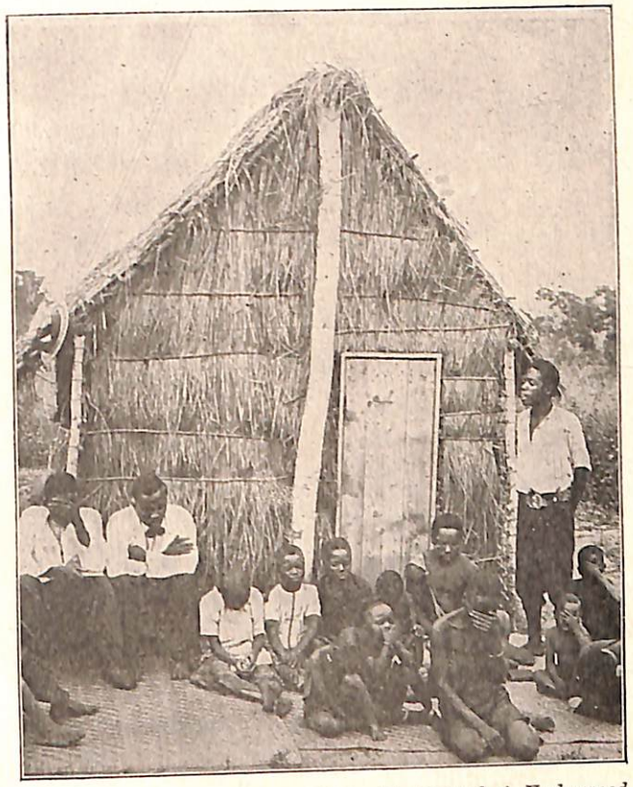
After the work of the twelve apostles was finished, the church began to depart from the right path, until finally the light of truth was nearly put out. This period of darkness has been called the "Dark Ages." Christ, in speaking of this time, says, "Then shall be great tribulation. . . . And except those days should be shortened, there should no flesh be saved; but for the elect's sake those days shall be shortened."



Just a few years before the period of darkness ended, God raised up Luther, Melanchthon, Zwingle, Huss, and other faithful reformers; and by their earnest labors the persecution was lessened, and the days were thus shortened.

Since that time God has had many faithful messengers, as the Wesleys, Hudson, Miller, Himes, and Litch.

The last three were used of God in the proclamation of the two angels' messages recorded in Rev. 14: 6-8. Now the third angel's message is going to the world, as recorded in the same chapter, verses 9-12. Among those who have been connected with the giving of this message are James White, Joseph Bates, J. N. Andrews, and Uriah Smith. These have finished their labors, but still the message is sounding.



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PRAYER MEETING AT A MISSION SCHOOL

"To every kindred, nation, tongue, and people"

What is the message? The reading of it shows that those who do not keep the commandments of God will be destroyed by fire; and the following verses speak of Christ's coming in a cloud. It is, then, the last message of mercy to the world; and after it has been given, the earth is to be destroyed by fire.

Before destroying the earth by water, God sent a warning message. Will He do the same before destroying it by fire? Will God destroy the earth by fire? The Bible tells us that God will do nothing but what He will reveal through His prophets. Has He revealed that such an event will take place? Listen: "But the heavens and the earth, which are now, . . . are kept in store, reserved unto fire against the day of judgment and perdition of ungodly men." This is the word of God through His inspired apostle Peter. He says again, "The day of the Lord will come as a thief in the night; in the which the heavens shall pass away with a great noise, and the elements shall melt with fervent heat, the earth also; and the works that are therein shall be burned up."

God sent a warning message before He destroyed the earth by water; and He will send such a message before He destroys the earth by fire. That message is sounding now, and it has been sounding ever since 1848 — over sixty years. It is the third angel's message of Rev. 14: 9-12. Just how much longer it will sound we do not know, but it will be until all nations have opportunity to hear it; and yet it must be finished in this generation.

We are living just before the coming of the Lord. Let us not do as did the antediluvians — the people who



lived before the flood; but let us believe the message God sends us, and do what we can to tell it to others. "Seeing then that all these things shall be dissolved, what manner of persons ought ye to be in all holy conversation and godliness, looking for and hasting the coming of the day of God, wherein the heavens being on fire shall be dissolved, and the elements shall melt with fervent heat?"

### Questions

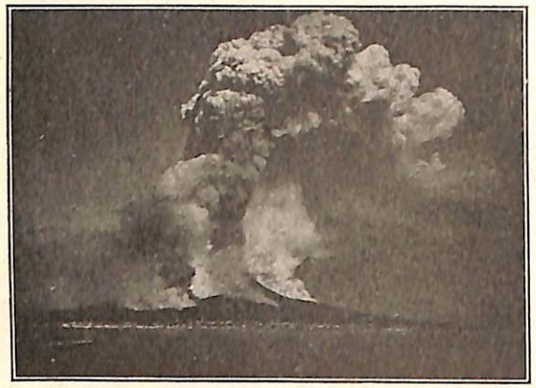
1. What promise did God make to Noah and his sons? What pledge did He give?
2. Has God given other messages to the world besides the one He gave through Noah?
3. Name some of the messengers of the Old Testament. Some of the New Testament. How were these messages and messengers received? 2 Chron. 36: 15, 16.
4. Mention some of the messengers that have lived since that time. What messages did they preach? Rev. 14: 6-8.
5. What message is going to the world to-day? Rev. 14: 9-12.
6. Does the word of God teach that the earth is to be destroyed by fire? When? Describe this great and terrible destruction. 2 Peter 3: 7-12.
7. Before destroying the earth by water, did God send a message? Does it seem reasonable to think He would send a message before destroying it by fire?
8. Which is easier for us to believe, the message of the destruction of the earth by flood, or the message of its destruction by fire? Why?
9. How should we live in view of this great event? Verses 12, 13.

# Lesson CXIX

## *Judgments in the Land*

**When Thy judgments are in the earth, the inhabitants of the world will learn righteousness. Let favor be showed to the wicked, yet will he not learn righteousness; in the land of uprightness will he deal unjustly, and will not behold the majesty of the Lord. Isa. 26: 9-11.**

As we have learned in a previous lesson, the judgments of the Lord are in the land, in cyclones, earthquakes, volcanic eruptions, etc. God permits Satan to bring these judgments on the earth. A good illustration of this is found in the first and second chapters of Job, where God allowed Satan to visit destruction on Job's property and afterward to afflict Job's body.



VESUVIUS, A VOLCANO IN ITALY, IN ACTION

God allows these things to come sometimes to test His children, and at other times to arouse the wicked as to their danger. He is telling in strongest language of His coming in judgment.

The following is a clear description of how Satan is working, and how far God will permit him to work: "Satan works through the elements also to garner his harvest of unprepared souls. He has studied the secrets of the laboratories of nature, and he uses all his power to control the elements as far as God allows. When he



was suffered to afflict Job, how quickly flocks and herds, servants, houses, children, were swept away, one trouble succeeding another, as in a moment. It is God that shields His creatures, and hedges them in from the power of the destroyer. Satan has control of all whom God does not especially guard. He will favor and prosper some, in order to further his own designs; and he will bring trouble upon others, and lead men to believe that it is God who is afflicting them.

MESSINA BEFORE THE EARTHQUAKE

"While appearing to the children of men as a great physician, who can heal all their maladies, he will bring disease and disaster, until populous cities are reduced to ruin and desolation. Even now he is at work. In accidents and calamities by sea and by land, in great conflagrations, in fierce tornadoes and terrific hailstorms, in tempests, floods, cyclones, tidal waves, and earthquakes, in every place and in a thousand forms, Satan is exercising his power. He sweeps away the ripening harvest, and famine and distress follow. He imparts to the air a deadly taint, and thousands perish

MESSINA AFTER THE EARTHQUAKE

by the pestilence. These visitations are to become more and more frequent and disastrous. Destruction will be upon both man and beast."

Satan is doing all this while probation still lasts, while the angels are holding the winds of strife and persecution. How much greater will be his work of destruction when probation is closed, and the Spirit of God is withdrawn from the earth. Then will be poured out the seven last plagues mentioned in the sixteenth chapter of the book of Revelation. While the plagues do their work of desolation, the promises contained in the ninety-first psalm will be fulfilled. At the beginning of the plagues, Christ ceases to intercede for sinners, and the decree goes forth, "He that is unjust, let him be unjust still: and he which is filthy, let him be filthy still: and he that is righteous, let him be righteous still; and he that is holy, let him be holy still."

At the end of the plagues, Jesus comes to gather those who have heeded the message and accepted Him as their Saviour. "What a gathering of the faithful that will be!"

**Questions**

1. Who allows judgments to visit this earth? Why?
2. Who performs the work of desolation? Illustrate this by the case of Job.
3. Through what does Satan work? How does he know how to use the elements?
4. In what ways is Satan now working?
5. How will it be in the future?
6. What will follow when probation ceases, and God withdraws His Spirit from the earth?



7. Name the seven last plagues. Compare them with the plagues that came upon Egypt.
8. How long will these plagues continue? What psalm then will be the consolation of God's people?
9. What will take place at the beginning and what at the end of that period?

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# Lesson CXX

## *Triumphs of the Right*

**Shall not the Judge of all the earth do right? Gen. 18:25.**

After the plagues have wrought their work of destruction, and the righteous have been taken to heaven, and the wicked have been destroyed by the brightness and glory of Christ's coming, the earth will be a scene of complete ruin and desolation. The prophet Jeremiah, speaking of this desolation, used the same words that Moses used in describing this earth before light had been created: "I beheld the earth, and, lo, it was without form, and void; and the heavens, and they had no light."

Satan will be here on the earth alone; and while he will not have been able to keep all under his control, yet by far the greater portion of earth's inhabitants will be under his power,— the power of death. Lifeless forms will be strewn over the whole earth; and those who have served him in past ages will be buried beneath the earth's surface. While Satan can not boast of a complete victory, yet he probably will try to get satisfaction in the thought that he still holds possession of the earth.

He will have a thousand years to console himself with that thought, and to think of the rebellion he started in heaven, and the work of deception he has carried forward on this earth for six thousand years.

Finally that long period of idle contemplation will be broken by the sight of a pathway of light from heaven to earth, down which a city of glory and beauty descends. He will hear the rustling of the mighty host of his dead subjects as they come forth from their dusty graves. Then he becomes the commander of that mighty army, which has among its numbers the great generals of earth whom he has directed in their cruel wars. As the glorious city with transparent walls settles near the earth, and a company far less in number than those that are in his ranks, take possession, he will think the opportune time has come for him to march into the city, overpower its inhabitants, and thus gain a complete victory over Christ. His immense army will close in about the city; but fire will come down from God out of heaven, and devour Satan and his hosts, and the flames will not cease their burning until they consume all of earth's impurities. So intense will be the heat, that the very earth will be dissolved, and the globe will become a molten sea, on which the city of God rides, as Noah's ark rode on the waters of the flood.

The long conflict will then be over, and complete and eternal victory will at last have come to the side of truth and right. Those of God's people who have been in the severest of the conflict, who have seen the desolating power of Satan on the earth, will, according to the Saviour's promise, behold "new heavens and a new earth, wherein dwelleth righteousness." It will be their blessed privilege to see the earth as God clothes it again with beauty, and fills it with happy creatures.



### Questions

1. How does Jeremiah describe the appearance and condition of the earth as it will be after the seven last plagues?
2. Describe the conditions that will exist on the earth during the thousand years the saints are in heaven.
3. What events will break the long night of silence and contemplation?
4. What impulses come into Satan's heart and mind?
5. Describe his plans, and his efforts to carry them out.
6. What will be the result of Satan's final desperate effort to become supreme?
7. What transformations take place *in* and *on* the earth?
8. What long-cherished promise will be at last fufilled, thus richly repaying the redeemed for all disappointments and suffering that have been their lot during the cruel reign of sin? Isa. 65: 17-19.
9. What glorious scene will they be permitted to behold that in the beginning caused the morning stars to sing together, and all the sons of God to shout for joy?

### Note Book Requirement

On page 110 give in their order the events from the close of probation until the earth is purified by fire.

Read Rev. 22: 11, 12; 1 Thess. 4: 13-18; Rev. 22; Rev. 21: 1-4; 2 Peter 3: 7-14.

CHAPTER XVI

# THE NEW EARTH

*(Scripture Basis, Revelation 21 and 22)*

*"Behold, I create all things new."*

## Lesson CXXI

### *All Things New*

**Be ye glad and rejoice forever in that which I create: for behold, I create Jerusalem a rejoicing, and her people a joy. Isa. 65:18.**

After the purifying fires have cleansed the earth from every trace of sin, the glorious sun will appear in the heavens shining with a radiance never seen by mortal eyes. As the sun sets at the close of the first new day in the new earth, the moon will rise in surprising brilliancy. But God's people will remember that this is according to His promise, "The light of the moon shall be as the light of the sun, and the light of the sun shall be sevenfold, . . . in the day that the Lord bindeth up





the breach of His people, and healeth the stroke of their wound."

But even though the light of the sun and moon will be so great, the New Jerusalem can get along without them. The city will have no need of the sun or of the moon; for the glory of God will lighten it.

A PERFECT TREE

While the light of the sun will be much greater than now, yet there will be no suffering from the heat; but the promise of God will be fulfilled, "Neither shall the sun light on them, nor any heat."

The air will be pure, fresh, and invigorating. The ruddy glow of health will be upon every countenance. There will be no more pain, distress, nor disease. "The inhabitant shall not say, I am sick." "There shall be no more death, neither sorrow, nor crying: . . . for the former things are passed away."

Beautiful vegetation will appear; there will be no thorns, briers, nor thistles. "Instead of the thorn shall come up the fir tree, and instead of the brier shall come up the myrtle tree." "The desert shall rejoice, and blossom as the rose."

Next will come forth the animals, abounding with life and activity. The spirit of antagonism will all be gone.

As the redeemed look upon the creatures that God has created, and see them moving about in their innocence and harmlessness, they will see the complete fulfillment of the promises they have read in the Scriptures: "The wolf and the lamb shall feed together, and the lion shall eat straw like the bullock." "The cow and the bear shall feed; their young ones shall lie down together." "The leopard shall lie down with the kid; and the calf and the young lion and the fatling together; and a little child shall lead them." "They shall not hurt nor destroy in all My holy mountain: for the earth shall be full of the knowledge of the Lord, as the waters cover the sea."

With the animals, the work of creation will cease; for the inhabitants of the new earth will be the redeemed sons and daughters of Adam and Eve. "The Son of God redeemed man's failure and fall; and now, through the work of the atonement, Adam is reinstated in his first dominion. Transported with joy, he beholds the trees that were once his delight,— the very trees whose fruit he himself had gathered in the days of his innocence and joy. He sees the vines that his own hands have trained, the very flowers that he once loved to care for. His mind grasps the reality of the scene; he comprehends that this is Eden restored, more lovely now than when he was banished from it. The Saviour leads him to the tree of life, and plucks the glorious fruits, and bids him eat. He looks about him, and beholds a multitude of his family redeemed, standing in the Paradise of God. Then he casts his glittering crown at the feet of Jesus, and,



falling upon His breast, embraces the Redeemer. He touches the golden harp, and the vaults of heaven echo the triumphant song, 'Worthy, worthy, worthy is the Lamb that was slain and lives again!' The family of Adam take up the strain, and cast their crowns at the Saviour's feet as they bow before Him in adoration.

"This reunion is witnessed by angels who wept at the fall of Adam, and rejoiced when Jesus, after His resurrection, ascended to heaven, having opened the graves for all who should believe on His name. Now they behold the work of redemption accomplished, and they unite their voices in the song of praise."

The New Jerusalem, with its "many mansions," becomes the metropolis of the new earth. Besides their palaces in the city, the saints build for themselves homes in the country, and there they plant and care for their gardens and vineyards.

There will be no uncertainty connected with their labor, and their work will be a joy. "They shall not build, and another inhabit; they shall not plant, and another eat; for as the days of a tree are the days of My people, and Mine elect shall long *enjoy* the work of their hands. They shall not labor in vain, nor bring forth for trouble." Besides building and planting, other lines of work will be carried forward, and "the loftiest aspirations reached, the highest ambitions realized; and still there will arise new heights to surmount, new wonders to admire, new truths to comprehend, fresh objects to call forth the powers of mind and soul and body."

Questions

1. How will the sun and moon appear in the new earth? Isa. 30:26.
2. How will the New Jerusalem be lighted? Rev. 21:23.
3. How about the heat in the new earth? Rev. 7:16.
4. What will be the condition of the atmosphere? What will be the state of health? Isa. 33:24.
5. What change takes place in the vegetation? Isa. 55:13.
6. What change in the animals? Isa. 11:6-8; 65:25.
7. Describe Adam's reinstatement as ruler of the lost dominion. How will Adam and his children show their gratitude to their Redeemer for their restoration?
8. What will be the metropolis of the new earth?
9. Where will the redeemed live? How will they employ their time? Isa. 65:21-23.
10. What results will attend all their labors?

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## Lesson CXXII

*A Clean Universe*

**And every creature which is in heaven, and on the earth, and under the earth, and such as are in the sea, and all that are in them, heard I saying, Blessing, and honor, and glory, and power, be unto Him that sitteth upon the throne, and unto the Lamb, forever and ever. Rev. 5:13.**

Those of the redeemed who accept the last warning message to the world, and pass through the seven last plagues,— a company numbering one hundred and forty-four thousand,— will take their position on the sea of glass before the throne of God. This company will have passed through more trying experiences than any other



people have ever been called to pass through, and will have gained a complete victory. Because of their deeper experience under great persecutions, they will sing "a new song" before the throne,— a song which no man can learn save the one hundred and forty-four thousand. They will "follow the Lamb whithersoever He goeth." They will go with Jesus from world to world, singing the song of victory, the "song of Moses and the Lamb," which is nothing else than the song of their experience in gaining the victory over sin.

This is an experience that the unfallen beings of other worlds know nothing of. It is to them indeed "a new song." Our world is the only one that has ever fallen under the power of sin and death. For over six thousand years it has been a dark, polluted spot in the great universe. God the Father, Christ the Son, and the myriads of sinless beings of other worlds, with pitying eyes and aching hearts have looked upon this earth suffering untold sorrow and misery because of man's yielding to the temptations of Satan. Not only has this world suffered; but many of the angels of heaven yielded to Satan's artful deceptions, so that for a time heaven was tainted with sin. But Satan and his angels were cast out, and the conflict between good and evil has been confined to this world.

Long and fiercely has it raged; but the saints of God will be triumphant. "Sin and sinners will then be no more. The entire universe will be clean. One pulse of harmony and gladness will beat through the vast creation. From Him who created all, will flow life and light and gladness, throughout the realms of illimitable space. From the

minutest atom to the greatest world, all things, animate and inanimate, in their unshadowed beauty and perfect joy, will declare that God is love.

"And the years of eternity, as they roll, will bring richer and still more glorious revelations of God and of Christ. As knowledge is progressive, so will love, reverence, and happiness increase. The more men learn of God, the greater will be their admiration of His character. As Jesus opens before them the riches of redemption, and the amazing achievements in the great controversy with Satan, the hearts of the ransomed thrill with more fervent devotion, and with more rapturous joy they sweep the harps of gold; and ten thousand times ten thousand and thousands of thousands of voices unite to swell the mighty chorus of praise."

**Questions**

1. What company will stand on the sea of glass before the throne of God? Rev. 14: 1-3; 15: 2-4.
2. What song will they sing? Can others join with them in singing this song? Why not?
3. What special privilege will this company have? Rev. 14: 4.
4. How has our world been regarded as related to the universe? What efforts have been made to cleanse it?
5. As the redeemed stand on the sea of glass, what is the condition of the universe?
6. As the years of eternity roll on, what will the redeemed learn?
7. Who will be in charge of the heavenly school, and what will He teach?
8. Show that our study in the nature class has been the study of God's plan in creation and redemption.